DOCUMENT RESUME

ED 080 889 CE 000 107

AUTHOR	Olmstead, Joseph; And Others
TITLE	Components of Organizational Competence: Test of a Conceptual Framework.
INSTITUTION	Human Resources Research Organization, Alexandria, Va.
SPONS AGENCY	Office of the Chief of Research and Development (Army), Washington, D.C.
REPORT NO	HumRRO-TR-73-19
PUB DATE	Aug 73
NOTE	117p.; Work Unit:Forge I
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	*Leadership Training; Management Education; *Military Science; Military Training; *Models; *Organizational Development; *Simulation
IDENTIFIERS	Adaptive Coping Cycle

ABSTRACT

The study was designed to identify and isolate critical organizational processes that influence the effective performance of command and control functions in complex organizations, with the aim of improving ability to control these factors. A framework was developed based on "Organizational Competence"--the capacity of an organization to cope with continuously changing environments--and a supporting method of study was discussed. Analysis was based on seven critical processes constituting the "Adaptive-Coping Cycle". Ten 12-man groups of experienced Army officers participated in an eight-hour role simulation of a light infantry battalion engaged in combat operations. It was concluded that Organizational Competence is a principal determinant of effectiveness, that an organization's ability to respond flexibly to pressures and changes in its environments is related to its competence, and that proficient performance of the identified processes improves effectiveness. A 17-item bibliography is included. (AG)

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Components of Organizational Competence: Test of a Conceptual Framework

CE

Joseph A. Olmstead, Harold E. Christensen, and L. L. Lackey

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street • Alexandria, Virginia 22314

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August 1973

Prepared for

Office of the Chief of Research and Development
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October 2, 1973

DARD-ARS-B

SUBJECT: Components of Organizational Competence: Test of a Conceptual Framework" Work Unit FORGE

1. Military organizations must be capable of responding effectively to uncertainty situations, which occur in an almost constant flow. This report explores the human factors that can impede or improve ability to identify and cope with problems in operational environments. The research was designed to explore organizational processes critical to effective functioning.

2. The study involved the development of a conceptual framework based upon the concept of Organizational Competence, together with an Adaption-Coping Cycle made up of seven critical processes: Sensing, Communicating Information, Decision Making, Stabilizing, Communicating Implementation, Coping Actions, and Feedback. Ten 12-man groups of experienced Army officers then participated in an eight-hour role simulation of a light infantry battalion engaged in combat operations developed in the research. At the close of the exercise, each player rated the realism, involvement, and pressure experienced during the simulation. Experienced officers analyzed the content of the player communications for quality of process performance and evaluated the organizations' activities for military effectiveness. Organizational Competence was found to be a principal determinant of an organization's effectiveness, as well as its flexibility; proficient performance of the seven critical processes improves effectiveness.

3. This report should interest those concerned with the theory of organizational effectiveness and with simulation and other training approaches to increased effectiveness.

FOR THE CHIEF OF RESEARCH AND DEVELOPMENT:

R. O. VITERNA
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Chief, Behavioral
Sciences Office

ED 080089

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Components of Organizational Competence: Test of a Conceptual Framework

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HumRRO Division No. 4
Fort Benning, Georgia

HUMAN RESOURCES RESEARCH ORGANIZATION

Work Unit: FORGE I

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The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under contract with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

Published
August 1973
by
HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street
Alexandria, Virginia 22314

Distributed under the authority of the
Chief of Research and Development
Department of the Army
Washington, D.C. 20310

FOREWORD

The primary purpose of the research reported here was to identify and isolate critical organizational processes that influence the effective performance of command and control functions in complex organizations. The work was performed by the Human Resources Research Organization under Work Sub-Unit I of Work Unit FORGE, Factors in Military Organizational Effectiveness, the objective of which is to identify and obtain better understanding of human factors that influence organizational effectiveness. Earlier work had been performed under Exploratory Research 51, Organizational Effectiveness.

The work, begun in July 1968 and completed in June 1971, was conducted at HumRRO Division No. 4, Fort Benning, Georgia. Dr. T.O. Jacobs is Director of the Division and Dr. Joseph A. Olmstead is FORGE Work Unit Leader. LTC L.P. Withers (USA-Ret) developed the scenario, materials, and procedures, and served as Chief Controller for the simulation that was used to study organizational performance. COL Arthur J. DeLuca (USA-Ret), MAJ Shelton V. Peters, MAJ Lanny L. Peterson, CPT Lawrence J. Dacunto, CPT Allan J. Holmes, and CPT Peter H. Ward also served as controllers. Mr. Lyman K. Harris developed and operated the communications and recording systems. In addition to the authors, other HumRRO professional personnel who participated in the research were LTC Fred K. Cleary (USA-Ret), LTC Paul F. Ferguson (USA-Ret), Dr. Douglas S. Holmes, Dr. Guillermo F. Mascaro, and Mr. Jon E. Roeckelein.

Military liaison and support were provided by the U.S. Army Infantry Human Research Unit of which LTC F.O. Barger, Jr., and LTC Chester I. Christie served as Chiefs during the data collection and data analysis phases, respectively. LTC Willys E. Davis is the current Chief. USIHRU personnel who also participated in the work were SP4 James L. Dunlavey, SP4 Louis E. DeGreeff, SP4 John M. Loersch, and SP4 Norris Sonntag.

HumRRO research for the Department of the Army is conducted under Contract DAHC 19-73-C-0004. Basic Research in Military Group Effectiveness is performed under Army Project 2Q061102B74B.

Meredith P. Crawford
President
Human Resources Research Organization

SUMMARY AND CONCLUSIONS

THE PROBLEM

To be effective, every military organization must efficiently identify and cope with problems that arise within its operational environments. The necessity for continuous readiness and quick reaction in turbulent and unpredictable environments places a premium upon the capability of organizations to respond flexibly to a more or less constant flow of uncertainty situations. Furthermore, technological advances in weapons systems, electronics, and logistics complicate both organizational decision processes and the execution of required operations

With these greater requirements for flexible responses, present and future organizations must depend upon fast acquisition and use of intelligence, speedy and accurate communication, and swift reaction to external pressure. The organizations must be able to search out, identify, and interpret the properties of operational situations as they develop. They must be able to solve problems within the context of rapidly changing situational demands, to generate flexible decisions and react to shifting demands. The source of these capabilities within an organization is the command and control system.

Clearly, these capabilities depend upon human factors. Some technological assists, such as sophisticated communications and data processing systems, can be provided; effectiveness ultimately depends on the judgments and actions of key personnel.

There is little systematic knowledge about these complex human factors. Accordingly, effective control of the factors in command and staff activities is either fortuitous or the result of long on-the-job practice by highly experienced leaders. Specific information is needed on the human factors involved in command and control activities and for better understanding of their contributions to organizational responsiveness, flexibility, and effectiveness. Such knowledge would enable commanders to control their units better, and would contribute to improved training in command and control activities. Additional benefits would be improved techniques for assessing organizational functioning and for evaluating the performance of command and control activities.

APPROACH

The purpose of Work Unit FORGE is to explore the human factors within organizations that impede or enhance command and control activities, with the aim of improving ability to control these factors. To accomplish this purpose, a conceptual framework and a supporting method of study were developed.

The framework was developed around several concepts that are subsumed under the rubric "Organizational Competence," which is the capacity of an organization to cope with continuously changing environments. Competence was conceived to be a major determinant of Organizational Effectiveness. Where Effectiveness is the final outcome (mission accomplishment, productivity, etc.), Competence is the ability of the organization to perform certain critical operational functions, or processes, that lead to Effectiveness. When the processes that comprise Competence are performed well, they enable an organization to be effective. When performed poorly, they may negate many of the positive effects contributed by efficiency in other areas.

Organizational Competence was conceived to consist of three identifiable components that, in turn, are composed of several basic organizational processes. The components and the processes that comprise them are as follows:

(1) Reality-Testing—The capacity of the organization for accurately determining the real properties of its operational environments. Reality-Testing consists of the following processes:

(a) Sensing—Information acquisition and interpretation.

(b) Communicating Information—Transmittal of information to those parts of the organization that can act upon it.

(c) Feedback—Obtaining of information on the results of actions taken.

(2) Adaptability—The problem-solving capacity, which, in turn, depends upon flexibility of the organization. Flexibility is the ability to learn through experience and to change with shifting internal and external circumstances. Adaptability consists of the following processes:

(a) Decision Making—Solving problems and making decisions.

(b) Communicating Implementation—Processing information concerning actions to be taken.

(c) Coping Actions—Executing actions required by environmental changes.

(3) Integration—The maintenance of structure and function under stress and of a state of relations among sub-units that ensures coordination. Integration consists of the following process:

(a) Stabilizing—The taking of actions to maintain internal stability and integration that might otherwise be disrupted as a consequence of actions taken to cope with changes in the organization's environments.

For purposes of analysis, the seven critical processes were conceived to occur in a sequence that is labeled the "Adaptive-Coping Cycle." The sequencing of processes within the cycle is as follows: (a) Sensing, (b) Communicating Information, (c) Decision Making, (d) Stabilizing, (e) Communicating Implementation, (f) Coping Actions, and (g) Feedback.

The present study was based upon this conceptual framework and was designed to accomplish the following objectives:

(1) To determine the relationship between Organizational Competence and Organizational Effectiveness within Infantry battalions.

(2) To evaluate the separate contributions to Effectiveness of each of the components and determine the relative contributions of the organizational processes used to operationalize these components.

(3) To determine the effects of environmental pressures upon Competence and establish the relationship between Effectiveness and the ability of an organization to maintain Competence under pressure from its environments.

(4) To obtain certain descriptive data concerning the Competence performance of a battalion command and control system, while it operates within a tactical environment.

METHOD

Ten 12-man groups of Vietnam-experienced Infantry officers, ranging in grade from senior major to first lieutenant, participated in an eight-hour role simulation of a light infantry battalion engaged in combat operations in Vietnam. All inputs into the simulated

battalion were made by experimenter/controllers who filled the roles of personnel at brigade, platoon, and adjacent unit levels. Through the use of preplanned and tightly scheduled messages, controllers created a dynamic and realistic situation that provided continual and changing environmental inputs requiring rapid and flexible organizational responses from the simulated units. The simulate scenario consisted of 128 "probes" (problems) made up of 376 separate input messages. Although activities of the players were uninterrupted, the simulate was designed in four administrative phases, three of which differed in the intensity of environmental pressures, as determined by frequency, complexity, and criticality of inputs.

The bases of data were (a) players' ratings of realism, involvement, and pressure experienced during the simulation, and (b) all communications (radio, written, and face-to-face) of members of the simulated organizations. Communications of the players were the source of data for evaluation of both Organizational Competence and Organizational Effectiveness.

The analysis of Organizational Competence included (a) content analysis of each unit of communication according to a system that classified it in terms of 12 descriptive categories and identified the organizational process performed by the unit; (b) assignment of a score to each unit in terms of how well the process represented by it was performed; and (c) the development of group scores for each organizational process, competence component, and competence as a whole. Scores for processes, competence components, and competence were determined by the quality of process performance.

Organizational Effectiveness was determined by the military outcomes of the 128 probes. Experienced officers examined transcripts of communications concerning each probe and assigned an effectiveness score according to predetermined criteria concerning contribution of the outcome to mission accomplishment. Group Effectiveness scores were summations of scores for the 128 probes.

RESULTS

Players rated the simulation as (a) more interesting than other command post exercises in which they had participated, (b) quite realistic in the problems and procedures used, (c) high in the extent of player involvement, and (d) high in probability that battalions which were effective in the simulation would also be effective in a real situation. Furthermore, players' ratings of the amount of pressure experienced during the various phases were in accord with the experimental design. It is concluded that the validity of the simulation was high, which permits confidence in the substantive findings of the study.

During the simulation, the 10 groups averaged 1,377 contacts. These contacts resulted in a mean of 1800.7 scoring units per group. Group mean units per probe were 14.1. These data indicate that each group produced a large number of communications for scoring, thus ensuring that scores developed from them are genuinely representative of the groups' performance.

An analysis of frequency of process performance in relation to Organizational Effectiveness resulted in a correlation coefficient of .33, which was not significant ($N = 10$). This finding indicates that Effectiveness was not related to the frequency with which processes were performed by the simulated organizations.

For this study of 10 groups, the most important finding is concerned with the relationship between Organizational Competence and Organizational Effectiveness. The obtained correlation coefficient of .93 is highly significant ($p < .01$), and indicates a strong relationship between the two variables. Under the conditions of this study, Competence accounted for 86% of the variance in Effectiveness. Therefore, it appears that Competence was a principal determinant of Organizational Effectiveness.

Zero-order correlations of Competence components with Effectiveness resulted in coefficients of .96 for Reality Testing, .79 for Adaptability, and .11 for Integration. Thus, both Reality Testing and Adaptability were related significantly to Effectiveness. The relationship of Integration to Effectiveness was quite small and not significant. This lack of relationship is explained in part by the few occurrences of Stabilizing, the one process of which Integration is composed. The results concerning Stabilizing and Integration are deemed to be inconclusive because of insufficient data.

A multiple correlational analysis between the Competence components and Effectiveness resulted in a corrected coefficient of .94. Beta weights were .79 for Reality Testing, .25 for Adaptability, and −.08 for Integration. Relative contributions to Effectiveness were 76% for Reality Testing and 20% for Adaptability, while the contribution of Integration was negligible (−.008%). It is apparent that Reality Testing and Adaptability were critical determinants of Organizational Effectiveness. Reality Testing contributed more than Adaptability, which demonstrates the importance of information acquisition and information processing to the effectiveness of military organizations.

For all processes except Stabilizing and Feedback, correlations with Effectiveness were significant beyond the .05 level of confidence. Sensing produced the highest correlation (.92), Communicating Information was second highest (.83), and Decision Making, Communicating Implementation, and Coping Actions were somewhat lower and approximately equal (.70, .71, .72).

An important finding is the linkage among the five processes found to be significantly related to Effectiveness. Performance of processes that occur later in the Adaptive-Coping Cycle was found to be dependent upon the quality of early ones. This finding indicates that the capability of an organization for coping with its environments depends upon equally effective performance of each process, both separately and in combination.

To analyze the effects of environmental pressure upon Competence, performance of the five groups that were highest in Effectiveness (High Effectiveness Groups) was compared with that of the five groups that were lowest in Effectiveness (Low Effectiveness Groups). Analysis-of-variance procedures were used to compare the Competence of the classes of groups across the three pressure phases (Low, Moderate, and High).

Competence of the High Effectiveness groups was significantly better than for Low Effectiveness groups in all phases. In addition, when faced with a change in mission and operations under moderate pressure, Competence deteriorated for both groups, but much more drastically for Low Effectiveness groups. After deterioration in Competence occurred, Low groups continued to function at a reduced level for the remainder of the simulation, whereas High Effectiveness groups recovered their initial level of Competence and maintained it even under High Pressure conditions.

A similar analysis for Competence components showed that Reality Testing deteriorated with change in mission and increased pressure, but recovered for both classes of groups. Patterns of Reality Testing for the two types of groups were similar, although performance was consistently better for High Effectiveness groups. On the other hand,

patterns for Adaptability were different. For High Effectiveness groups, scores for Adaptability remained essentially the same throughout the three pressure phases. However, Adaptability scores for Low Effectiveness groups showed a continual degradation as pressure increased. Therefore, it appears that Effectiveness of Low groups was less because of (a) consistently lower performance of Reality Testing and (b) a breakdown in Adaptability processes under increased environmental pressure.

Aborted decisions are those for which no implementing actions are performed. A comparison between High Effectiveness and Low Effectiveness groups showed that, throughout the simulation, Low groups aborted more decisions. In addition, when they experienced the High Pressure phase, the mean increase in aborted decisions for High Effectiveness groups was only .4; for Low Effectiveness groups, it was 7.6. Under the stress of strong environmental pressure, processes for implementing decisions broke down much more often in the Low Effectiveness groups, but continued to function reliably in the High Effectiveness groups.

An analysis of process performance by organizational position showed a clear pattern. Sensing was performed predominantly by maneuver company personnel. Communicating Information was performed most frequently by the S3, and Decision Making was most heavily centered in the battalion commander, S3, and company commanders. Although not performed often by anyone, Stabilizing was performed most frequently by company commanders; Feedback actions were not performed often enough to yield a discernible pattern. Staff officers performed Communicating Implementation most often, while Coping Actions, as expected, were executed predominantly by company commanders.

CONCLUSIONS AND IMPLICATIONS

The results of this study permit the following conclusions:

(1) Organizational Competence is a principal determinant of the effectiveness of organizations.

(2) Competence is concerned with the quality of organizational processes. The frequency with which processes are performed is not related to effectiveness.

(3) When the processes of which Competence is comprised are performed proficiently, an organization will be more effective. When the processes are not performed proficiently, effectiveness will be reduced.

(4) The organizational processes that comprise Competence contribute differentially to effectiveness; however, most contribute in significant degrees and the causal linkage between the processes makes it essential that all be performed proficiently.

(5) The ability of an organization to respond flexibly to changes in its operational environments is related to its Competence.

(6) The ability of an organization to maintain effectiveness under pressure from its environments is related to its Competence.

(7) The conceptual framework used in this study is a valid and practical means for understanding, analyzing, and evaluating the internal functioning of an organization.

(8) The conceptual framework provides a meaningful, concrete basis for developmental efforts intended to improve the internal functioning of complex organizations.

The findings of this study have significant implications for the study and improvement of organizational functioning. For numerous reasons, organizational processes have not received adequate attention in attempts to improve the performance of organizations. The principal contribution of this study is a concrete demonstration of the importance of organizational competence as a determinant of effectiveness, of the relative contributions of the various processes, of the systematic relationships that exist among them, and of the ways in which change and pressure affect their performance. It is now apparent that competence plays a critical role in the performance of organizations and, accordingly, warrants major attention in efforts to improve effectiveness.

Competence is the quality of performance of an organization's command and control system. Therefore, the importance of competence for military tactical units seems self-evident. The development of competence within an operational unit can be expected to result in a more smoothly functioning command and control team; in adjustment to changes in operational environments with a minimum of wasted effort, lost motion, or reduced effectiveness; and in maintenance of higher levels of effectiveness under the pressures of combat.

In nontactical organizations, both military and nonmilitary, processes may be somewhat ambiguous, often complex, and sometimes more difficult to trace. Nevertheless, attention to Competence is equally, if not more, important for these organizations than for tactical ones. It appears that the quality of process performance is a critical consideration regardless of the type of organization.

In many organizations, competence is less than adequate because little systematic attention is given to the improvement of process performance. However, the concepts subsumed under the rubric "Organizational Competence" offer potential for overcoming this problem. They constitute a workable framework for analyzing the internal functioning of an organization and for correcting dysfunctional aspects through redesign or developmental activities that involve both individual and team training.

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Components of Organizational Competence: Test of a Conceptual Framework

Chapter 1

INTRODUCTION

This report describes the first sub-unit of HumRRO Work Unit FORGE, a project with the purpose of investigating certain human factors that influence the effectiveness of complex organizations, and discovering ways to enhance effectiveness by better control of these factors. FORGE I, the sub-unit reported here, was concerned with the isolation of those organizational processes that contribute to effectiveness, and determination of ways in which the processes influence organizational performance. A second sub-unit will be devoted to identification of social-psychological factors that affect performance of the processes, and to development of techniques for more effective control of the factors.

THE PROBLEM

To be effective, every organization must efficiently identify, solve, and cope with problems that arise within its operational environments. Performance of these functions has always been important for organizational success, but recent developments have made these functions both more essential and more difficult. The turbulent and unpredictable environments that are characteristic of the present, and anticipated for the future, place a premium upon the capability of organizations to respond flexibly to a more or less constant flow of uncertainty situations. Yet this responsiveness must be accomplished in the face of technological advances in communications, equipment, and logistics that complicate both organizational decision processes and the execution of required operations.

Under such conditions, present and future organizations, with their greater requirements for flexible responses, must depend upon fast acquisition, processing, and use of information, speedy and accurate communication, and swift reaction to external pressure. Therefore, these organizations must possess the capabilities to search out, accurately identify, and correctly interpret the properties of operational situations as they develop, to solve problems within the context of rapidly changing situational demands, to generate flexible decisions relevant to these situations, and to react to shifting situational demands with precise appropriateness.

It is apparent that the capabilities described above are mainly dependent upon human factors. Some technological assists can be provided—for example, highly sophisticated communications systems and techniques and equipment for rapid compilation and processing of data. However, the payoff in effectiveness ultimately reduces to the judgments and actions of key personnel, both individually and collectively. These key personnel usually work in the management or command and control structure.

At present, little systematic knowledge is available concerning the specific effects of these human factors within complex organizations. Furthermore, most educational and training programs have little to say in this regard. Accordingly, effective control of the factors in most organizational activities is either fortuitous or the result of long on-the-job practice by highly experienced leaders.

There is a definite need for specific knowledge concerning the human factors involved in organizational responsiveness and flexibility, and for better understanding of

their contributions to organizational effectiveness. Such knowledge would enable leaders to better control their organizations and would contribute to improved training for leaders, managers, and staff personnel. Additional benefits would be improved techniques for assessing organizational functioning and for evaluating the performance of individuals in the execution of activities that determine organizational responsiveness and flexibility.

THE RESEARCH PROBLEM

The effectiveness of an organization depends upon many things. Some of the more critical factors are (a) the formal body of policies, procedures, and doctrine intended to guide decisions and actions, (b) the quality of techniques used in the performance of activities, (c) the adequacy of equipment that assists in the performance of required activities, and (d) the training and skills of individual personnel.

However, neither the logic of decisions, the adequacies of policies, procedures, techniques, and equipment, nor the skills of individual personnel in executing technical operations are, in themselves, sufficient to result in the responsive and adaptive system of organizational decision and action that is required. A remaining essential element involves competent performance of certain organizational processes that are necessary for the effective coordination of activities and the integration of information and decisions at many levels within the organization.

Included in these processes are the derivation and communication of objectives, the acquisition and processing of information, and the evaluation of alternative courses of action. Also included are processes involved in reaching and implementing decisions and in obtaining feedback on the results of actions that are taken. These processes whereby information, decisions, and actions are brought together involve a complex interplay between individuals, positions, and levels. This constant interplay is a critical element in organizational responsiveness and flexibility.

The purpose of the project reported here was to determine the specific contributions of some or all the adaptive processes to organizational effectiveness and, further, to establish the human determinants that influence effective functioning of the processes. Specifically, the objectives of the study were to (a) identify and isolate processes that are critical to the effective functioning of organizations, (b) determine the specific contribution of each process to effectiveness, and (c) determine how functioning of the processes is influenced by environmental pressures.

To accomplish the above objectives, the U.S. Army Infantry battalion was selected as the organization to be studied. The Infantry battalion is a prime example of organizations that must continually adapt to fast-changing environmental conditions. Furthermore, the comparatively short and clearly demarcated time frames characteristic of combat operations usually encompass most of the activities that occur over extremely long periods in more conventional organizations, thus permitting intensive examination of complete cycles of events critical to the units. On the other hand, except for the activities in which they engage and the stresses common to combat, tactical units are surprisingly similar to other organizations in their fundamental operating characteristics. For these reasons, the study reported here was concerned with U.S. Army Infantry battalions engaged in stability operations in a highly turbulent Southeast Asian environment.

Chapter 2

BACKGROUND

THE MILITARY ORGANIZATION

Military organizations are structures intended to function effectively in emergency situations. This is especially applicable for tactical units, where typical operational conditions include intense pressures from turbulent and rapidly changing environments. The function of these units is to cope with such pressures and to overcome forces in the environments that generate them.

This emphasis upon organizational responses to problem situations points up the role of the organization as problem solver and decision maker. Although individual members actually perform the problem-solving and decision-making activities, the necessity for global organizational responses makes it useful to conceive of the organization as a problem-solving and decision-making unit. An individual is severely limited in his capacity to deal with complex situations. An organization, on the other hand, makes it possible to analyze situations more understandably and, consequently, to develop more effective means for manipulating environments to accomplish missions.

The basic organizational technique is to (a) break down large problems into component parts, (b) assign responsibility for dealing with the segments to specialized units (e.g., staff sections) and to various levels, and (c) coordinate these separate efforts in a system of organizational decision and action. Thus, the characteristic form for coping with complex problems is a controlled and directed problem-solving and decision-making system. Even though a military organization still adheres to the principle of command responsibility for decision making, the complexity of problems and the organizational web within which the commander must operate reduces and qualifies his function as a single, individual information processer and problem solver.

The function of an organization is to act to achieve its goals or accomplish its missions. In general, its method is to coordinate the activities of its members so that all will be properly related and all will contribute to the ultimate objectives. More specifically, the method is as follows (1, pp. 15-16):

(1) The members of the organization are assigned specific decision-making responsibilities and action roles.

(2) The members are trained in some respects and indoctrinated in others to perform reliably in these assigned roles.

(3) Both decision-making and action responsibilities are distributed in terms of types of problem situations and in terms of superior and subordinate levels of authority.

(4) Standard Operating Procedures, including standard forms for the communication of information, decision, and action plans, are developed; these are most rigorously enforced at the lower levels of responsibility.

(5) The resulting structure and its standard procedures are then operated on the basis of a continuous flow of situation-decision-action.

The basic purpose is to take directed, unified action in an environment that presents a continuous flow of uncertainty situations. The principal device for maintaining this effort is the chain of command, which runs through the heart of the organization from

the topmost level to the lowest point of unit command. Ideally, the process for coping with uncertainty situations involves handling an "operational cycle" that flows up and down the chain of command and consists of situation—information—decision—action—altered situation—new information—supplementary decision—and so on (1, p. 18). The organization seeks to regulate this cycle without becoming inflexible in its responses.

In practice, however, the "operational cycle" is not usually so straightforward as described. For one thing, although the logical starting point for the cycle should always be a specific situation, there are, in reality, no concrete boundaries for many situations. Thus, some may overlap, or one may flow into another. Furthermore, there is no specific mechanism for recognizing a situation. Sometimes, information will reveal a situation. Sometimes, action taken in one creates another situation elsewhere. Frequently, one organizational level, by decision or action, creates a situation for another higher or lower level. Thus, the cycle tends to operate erratically.

In addition, the process whereby information, decisions, and actions are brought into conjunction involves a complex interplay between and among levels. For example, as information flows upward in the chain of command, parts are selected out and other items are added. The flow of directives downward is similarly affected. At the same time, decisions and actions from intervening levels enter into the flow of information and directives. The constant interplay that occurs is the essence of modern organizational process.

To control this interplay, organizations tend toward regulated and formal responses—they prefer the certainty of standardized procedures with their clearly demarcated and logically related stages. The reliability thus obtained is essential to unified effort. On the other hand, overreliance upon regulated responses tends to limit flexibility, a quality that is also essential in uncertainty situations.

There is often a precarious balance between rigidity and flexibility in military organizations. The point at which this balance is struck is a matter of considerable importance for effectiveness. Therefore, a major requirement for military organizations is to establish and maintain a workable balance between these two aspects of the organized decision-making, problem-solving, action-taking process.

EFFECTS OF ENVIRONMENTAL PRESSURES

A major concern within a military unit is developing an organization to function at peak efficiency even under extreme conditions and guarding it against disruption by pressures generated within its environments. Disruptions imposed by environmental pressures may initiate farreaching consequences. In combat, they may actually determine survival of the organization.

The effects of environmental pressure are diverse and, occasionally, even contradictory (2). On the one hand, pressure may lead to disruption of critical processes, which can seriously limit viability of the organization. On the other hand, pressure can result in closer integration, the development of appropriate problem solutions, and the enhancement of relevant actions.

Evidence concerning the general effects of environmental pressures is sparse. However, several relevant surveys of the effects of "crises" upon organizational functioning will be summarized here (2, 3, 4). A "crisis" is an event or situation that (a) threatens high-priority objectives of the organization, (b) presents a restricted amount of time in which a response can be made, and (c) is unexpected or unanticipated by the organization (2, p. 64). A crisis is an extreme situation and, as such, is analogous to many of the situations experienced by military units in combat.

Crises and reactions to them mainly affect the problem-solving, decision-making, and adaptive processes discussed in the previous section. For example, it has been found that, initially, information about a potential threat tends to be given low value (4). Organizations are frequently caught unprepared because available information from the environment is overlooked or disregarded. Recognition of the existence of an actual emergency often lags behind the occurrence of threat or even behind the impact of the emergency itself. Fragmentary and local reports are frequently available leading up to and following actual impact. However, only after these reports accumulate is it recognized that an emergency has occurred.

Much behavior during the immediate threat and the onset of the emergency is essentially a search for information. Accordingly, the time required to define the situation and put responses into effect is critical. The length of time that is required depends, in large part, upon the communication that occurs within the organization. Yet, in many emergency situations, the total number of communication channels used for the collection and distribution of information is reduced (2, p. 68; 5, p. 76). This is in contrast to the fact that there is frequently information overload (4, p. 17). The number of channels employed is reduced but, in those channels that remain, the amount of information may reach greater quantities than can be accommodated.

The compelling pressure to act and a compressed time perspective lead to increased errors in judgment. What is more, the required coordination of decisions and actions is frequently not supplied in the early stages. Then, as recognition of the gravity of the emergency increases, there is usually a tendency toward centralization of decision-making responsibilities (2).

Frequently, an organization struck with an emergency does not rapidly regain its ability to function. For example, inadequate communication often means that a serious or large error is required before it can be recognized and corrected. Because of lack of information, small errors go unnoticed.

Finally, there is a strong tendency to use stereotyped responses. The most familiar actions are those most likely to be taken, regardless of the situational requirements.

Needless to say, such factors as knowledge, experience, and training will restrict the tendencies just described. This is what military organizations attempt to accomplish through training, indoctrination, SOPs, contingency plans, and so forth. However, for this discussion, the important point is that those aspects of an organization most likely to be affected by environmental pressures are the problem-solving, decision-making, and adapting functions—those aspects that most determine the ability of an organization to cope with events in its environment. A critical question for this research is, "Why, under the strain of environmental pressures, do these functions break down in some organizations and not in others?"

EXPLANATORY CONCEPTS

Attempts to answer this question have been limited and have not been eminently successful. A principal reason for this notable lack of success appears to be the inadequacy of conventional approaches for coming to grips with some of the more complex aspects of organizational functioning. Bennis (6), probably the most articulate critic of the customary ways of approaching organizations, made this same point when he concluded that it is no longer adequate to view an organization as an analog to the machine, and that it is also not reasonable to view the organization solely in terms of the socio-psychological characteristics of organizational members, a recently fashionable viewpoint. Rather, Bennis contends that the approach which should be taken is to view organizations as "open systems defined by their primary task or mission and encountering

boundary conditions that are rapidly changing their characteristics." He argues that "the main challenge confronting today's organization. . .is that of responding to changing conditions and adapting to external stress" (6, p. 46).

Accordingly, Bennis concludes that the traditional approaches are "out of joint" with the emerging view of organizations as adaptive, problem-solving systems and that conventional studies of effectiveness are not sensitive to the critical needs of the organization to cope with external stress and change. According to Bennis, the present methods of evaluating effectiveness provide static indicators of certain output characteristics without revealing the processes by which the organization searches for, adapts to, and solves its changing problems. Yet, without an understanding of these dynamic processes of problem solving, knowledge about organizational behavior is woefully inadequate. Bennis further concludes that the methodological rules by which the organization approaches its task and interacts with its environments are the critical determinants of organizational effectiveness (6, p. 47).

In their search for an approach that will encompass the many varied aspects of organizations, Bennis and a number of other writers (7, 8, 9) have turned to General Systems Theory (10). In General Systems Theory, an organization is viewed as existing in an environment with which there are more or less continuous interchanges. As a system, the organization is regarded as having inputs (resources such as material, people, and information) on which it operates a conversion process (throughput) to produce outputs (products, services, etc.). Both the inputs and outputs must take account of environmental changes and demands (11).

Systems Theory embraces a much more comprehensive set of concepts than it is possible to describe here. Accordingly, an outline adapted from Schein (12) will serve to summarize those ideas that have the most relevance for this report:

(1) As an open system, an organization is in constant interaction, taking in materials, people, energy, and information, and converting these into products or services that are exported to the environment.

(2) As a system, an organization has many purposes or functions that involve numerous interactions with its environments. Many of the activities of organizational subsystems cannot be understood without recognition of these multiple interactions and functions.

(3) The many subsystems of an organization are in dynamic interaction with one another. It is as important to analyze the behavior of such subsystems as it is to analyze organizational events in terms of individual behavior.

(4) Subsystems are interdependent. Accordingly, changes in one subsystem are likely to influence other subsystems.

(5) An organization exists in a dynamic environment consisting of other systems. Since the environment constrains and places demands upon the organization in various ways, the functioning of the organization cannot be understood without full consideration of environmental demands and constraints.

(6) Multiple links between an organization and its environment make it difficult to clearly identify the boundaries of many organizations. Ultimately, an organization is perhaps better understood in terms of its processes rather than in terms of characteristics such as shape, function, or structure.

Of particular relevance for organizations is the concept of "equifinality." According to this principle, a system can reach the same final state from different initial conditions and by a variety of paths (7). The concept has special significance for organizations because it points up the importance of ongoing processes adapted for specific situations as major determinants of outcomes. Whereas the more traditional theories of bureaucracy rely upon rules, policies, and precedents to dictate action, and theories of decision rely

on rationality to indicate the obvious solution, Systems Theory recognizes that actions are governed by dynamic processes through which problems are approached as they arise and in accordance with their particular nature.

Basing his approach upon Systems Theory, Bennis has proposed that the major concern should be with "organizational health," defined in terms of "competence," "mastery," and "problem-solving ability." He then postulates some criteria for organizational health (6, pp. 52-54):

(1) *Adaptability*—which coincides with problem-solving ability which, in turn, depends upon flexibility of the organization. Flexibility is the freedom to learn through experience, to change with changing internal and external circumstances.

(2) *Identity*—Adaptability requires that an organization "know who it is, and what it is to do." It needs some clearly defined identity. Bennis says that identity can be examined in two ways: (a) by determining to what extent the organizational goals are understood and accepted by the personnel and (b) by ascertaining to what extent the organization is perceived veridically by the personnel.

(3) *Reality Testing*—The organization must develop adequate techniques for determining the "real properties" of the environment in which it exists. The "psychological field" of the organization contains two main boundaries, the internal organization and the boundaries with the external environment. Accurate sensing of the field is essential before adaptation can occur.

Thus, Bennis views an organization as an adaptive system and contends that the processes through which adaptation occurs are the proper focus of analysis.

A few other writers have stressed the potential of studying the problem-solving processes used by an organization. For one, Altman (13) contends that performance effectiveness should be viewed from a broad perspective, to include so-called "process variables" as intrinsic antecedents of performance outputs. Thus, Altman rejects the approach to organizational performance solely from the "black box" point of view. Instead, he proposes "a strategy of research that peers into the box and attempts to understand the sequential development of performance as it progresses from input to output" (13, p. 84).

Schein (9, pp. 98-99) goes beyond Altman and suggests an actual sequence of activities or processes used by organizations in adapting to changes in the environment. Schein calls this sequence an *adaptive coping cycle*. The stages in the adaptive coping cycle are:

(1) Sensing a change in the internal or external environment.

(2) Importing the relevant information about the change into those parts of the organization that can act upon it.

(3) Changing production or conversion processes inside the organization according to the information obtained.

(4) Stabilizing internal changes while reducing or managing undesired by-products (undesired changes in related systems that have resulted from the desired changes).

(5) Exporting new products or services that are more in line with the originally perceived changes in the environment.

(6) Obtaining feedback on the success of the change through further sensing of the state of the external environment and the degree of integration of the internal environment.

The swing to a process emphasis by such respected theorists as Altman, Bennis, and Schein signals a significant new development in ways of thinking about organizations.

Where, previously, attention was mainly focused upon the invariant aspects—the unchanging aspects of procedures, policies, structures, and relationships—there has now been recognition that the variant aspects may be the real key to understanding and controlling organizational behavior.

Thus, it has finally become apparent that with organizations, as with people, it is plainly necessary to focus attention on dynamics. Since an organization is an adaptive equilibrium-seeking organism, the processes through which adaptation occurs are a significant subject of analysis. It is, therefore, important to learn precisely how these processes influence and contribute to overall organizational effectiveness. It is equally important to understand what factors influence functioning of the organizational processes and what determines whether these processes can resist disruption under pressures arising from the environment.

Chapter 3

CONCEPTUAL FRAMEWORK

Work Unit FORGE was preceded by an exploratory study directed toward evaluating the feasibility of studying organizational functioning and identifying the best methods for conducting such a study. Early in the exploratory study, surveys of both organizational and methodological literature led to the conclusion that a combination of two factors would be essential to any project that was seriously intended to substantially increase understanding of such a complex phenomenon as organizational functioning. The two factors are (a) the development of a sound conceptual framework and (b) the use of carefully planned, theory-related methods for systematically collecting and analyzing data. Therefore, a substantial part of the exploratory study was devoted to developing a conceptual frame of reference within which organizational phenomena could be viewed. This chapter sets out the concepts that were the starting points for the study of organizational functioning and establishes the basic framework for the data collection phase of the study.

THE STRUCTURE OF VARIABLES

It is apparent that the emphasis upon organizational processes has come mainly from theorists rather than researchers. This is understandable since the processes are not easily amenable to the segmentation characteristic of most research efforts. In order to gain control over the phenomena under examination, empirical researchers are prone to break large problems into small parts that can be studied separately. The complex interactions between processes do not permit this to be done readily.

Probably a more significant reason for the dearth of research on organizational processes is that these processes appear to be mediating variables between inputs and outputs. Situations involving mediating variables are, of course, more difficult to analyze than the simpler independent variable - dependent variable relationships typical of most studies.

Thus, in the conventional study the researcher attempts to treat some factor, such as cohesiveness or leadership, as a predictor variable and then examine the relationship of this factor to some criterion such as productivity, goal achievement, or employee satisfaction. Productivity, goal achievement, and satisfaction are dependent variables. Although most of the studies concerned with the effects of social-psychological variables have been of this sort, findings have not been sufficiently consistent to demonstrate any clear-cut relationships. The reason may be that the studies have been too simply conceived.

However, when the problem is broadened to include organizational processes, more facets become clear. As "input," "predictor," or "independent" variables, there appear to be at least two broad classes: (a) factors related to the formal aspects of organization—structure, span of control, policies, procedures, degree of centralization, and so forth, and (b) individual and social-psychological factors—goals, motives, roles, cohesiveness, interpersonal relations, and so forth. Next, broadly considered, are the "output," "resultant," or "dependent" variables, such as effectiveness of the organization. Finally, interposed

between the independent and dependent variables are a group of factors that seem properly to be mediating variables, although for some analysis purposes they may be treated as dependent. In this group are organizational processes such as communication, problem solving, decision making, and information gathering.

It can be hypothesized that the overall effectiveness of an organization, as measured by mission accomplishment, is largely influenced by these organizational processes. Other things being equal, if the processes function well, organizational effectiveness should be enhanced. Efficiency of the processes, in turn, will be affected by formal structural or procedural factors and by social-psychological factors. In this way a missing link can be supplied. It seems reasonable that the conventional studies of social-psychological factors that influence effectiveness have been inconclusive because there is, in fact, no direct relationship between these factors and organizational performance. It appears that they, in some way, influence the organization's competence with regard to its operational processes and this, in turn, determines mission accomplishment.

The study reported here was designed to evaluate one part of the above hypothesis, that is, to determine the relationship between process performance and effectiveness. A second study will examine the effects of social-psychological factors upon performance of the processes. Through this two-step procedure, it will be possible to learn how organizational processes influence effectiveness and, in turn, are affected by other factors within the climate of an organization.

THE ORGANIZATIONAL CONCEPT

The conceptual framework for this study conceives of an organization as a social system existing in a physical and social environment over time. A human organization is defined as a complex network of relationships among a number of people who are engaged in some activity for some purpose where the activity requires a division of work and responsibility in such a manner as to make the members interdependent. The referent of the term *organization* is, operationally, the modern, large-scale business, military, or governmental organization. Specifically, in this study, the subject is an infantry battalion.

The "people" in the above definition are physical organisms and psychological processes. "Relationships among people" are states in which the activity and psychological state of one person is in a condition of mutual influence with another. A "network of relationships" is an abstraction of the relationships among a number of persons. The influence of a person is a function of his psychological properties and the properties of the coordinating and decision-making roles that he is assigned. The stability of the organization through time in relation to its purpose is obtained through a sufficient coincidence of the psychological fields of the personnel. For organizational achievement to be possible, shared understandings among the personnel are essential. A common means of communication, a common acceptance of purposes or subpurposes, and a common consent to the distribution of duties and responsibilities are required for large organizations.

The boundary of the organization as a unit of analysis can be established only in a relative manner. Comparative autonomy is one means of establishing boundaries. Another means is purpose and perceived membership. In the military context, the existence of a commanding officer may be considered to define an independent organizational unit.

"Purpose" is defined as the relationship of the organization to the external physical and social environment. In military units, the assignment of a mission may be considered to indicate the existence of a purpose. The mode of organization within a unit is, in part, determined by the purpose—the purpose dictates the method of distribution and execution of problem solving, decision making, and action functions.

The formal distribution of the above functions, and the assignment of authority and responsibility to go with them, define the formal structure of the organization. The functions are arranged and systematized on the basis of ideas as to how they should be effectively performed and logically coordinated—on the basis of what have been called the "logics of organization." In accordance with these logics, military organizations are characterized by (a) the rational determination of objectives and missions; (b) hierarchical arrangements of personnel in terms of authority, responsibility, coordination, and control; (c) missions that require the collaboration of sub-units to accomplish; and (d) a certain degree of autonomy in matters strictly internal to the unit.

Larger units (e.g., battalions) are broken down into smaller components (e.g., companies), each having a fairly independent identity. The components are, in turn, usually divided into even smaller identifiable elements (e.g., platoons and squads). Thus, an organization is laid out so as to create a precise format in which each unit is clearly charted and its missions assigned.

Like most organizations, military units operate according to a number of principles intended to maximize the effectiveness through controls. They include the following:

(1) There must be one central source of authority and decision making (unity of command).
(2) There must be clear-cut hierarchy of subordination (chain of command).
(3) There must be a routinized procedure for most activities (standardization of operations and functions).
(4) Tasks and subtasks should be standardized and personnel should be trained for specific tasks (specialization of function).
(5) Staff positions function in advisory capacities, but carry no formal authority for making decisions (line and staff functions).

While an organization is a formal structure of positions operated according to certain logics as just described, it is, at the same time, an adaptive social system. Considered as a structure of positions, an organization is a set of formal relationships that may be manipulated in the interest of efficiency and effectiveness. However, an organization is necessarily affected by conditions within the structure. Accordingly, the possibility of manipulating the formal system depends upon the extent to which the organization supplies effective motivation to participants and provides conditions within which the constructive stability of relationships is assured. In short, formal systems cannot be divorced from motivation and social relationships even within the most highly authoritarian structures.

From the standpoint of the organization as a structure of positions, persons are viewed functionally, in terms of formal definitions of their roles. However, formal role definitions cannot consider differences between individual human beings. In the same way, formal structures cannot take account of the deviations so introduced, and formal control mechanisms break down if relied upon alone. Thus, the existence of deviations tends to force a shift away from the purely formal structure as the principal determinant of effectiveness to a situation in which informal patterns of relationships exert a decided influence upon organizational activities.

Since organizations consist of individuals interacting within a formal structure of coordination, the organization as observed is a result of the reciprocal influences of formal and informal aspects. Therefore, a proper understanding of an organization requires that it be possible to relate changes in official activities to both the formal and the informal patterns within the unit.

In summary, an organization is conceived as a number of persons performing some activity in relation to their external environment—performance of the activity is the organizational process. The way the persons are arranged in relation to each other and the task is the structure of the organization. The persons in the system are conceived as

having various motivations and attitudes, and as performing certain activities in certain ways. The ways in which they perform the activities are, in part, determined by their motivations and by how they perceive the organization, other members, themselves, and their roles. The remainder of this conceptual framework deals with these various topics, with particular attention to use of the concepts for research purposes.

CONCEPT OF ORGANIZATIONAL EFFECTIVENESS

The specification of adequate criterion measures is one of the most difficult problems in designing research for the study of organizations. There are at least two major reasons for the problem. First, assuming that the objective is to determine an overall measure or index for the performance of the organization, it is obvious that one concept of the organization's operation is the extent to which the purposes, functions, and/or goals of the organization are achieved. In most organizational studies, the difficulty with this conceptualization is the researcher's inability to specify the purposes of the organization either abstractly or in terms of measurable variables.

Fortunately, military organizations, especially tactical ones, do not present this difficulty nearly as much as do other types, such as business organizations. Military units are assigned specific missions, usually the achievement of tactical objectives. It is comparatively easy to determine whether such objectives have been reached. Accordingly, for the study described in this report, the obvious criterion was whether the organization accomplished its tactical purposes.

The second problem arises from the fact that, in most organizational studies, not only is there a lack of clarity of the objectives, but, in addition, there are extremely difficult problems in measuring degrees of attainment. This was also a difficult problem in the present study. However, it was determined that the design specifications, to be described later, permitted the identification of concrete problems upon which performance could be evaluated.

Therefore, for this study, organizational effectiveness is defined as the extent to which a military unit accomplishes its missions. The criterion of effectiveness is adequacy of performance on problems presented by the various environments of the organization. This criterion was measured in terms of expert military judgment expressed on the basis of a set of systematic ratings that evaluated performance against carefully derived, pre-established criteria of adequacy.

CONCEPT OF ORGANIZATIONAL COMPETENCE

This section discusses a key concept in Work Unit FORGE. The concept of "organizational competence" is intended to encompass, within one term, the processes used by organizational systems to cope with continuously changing environments.

The concept derives from the conclusion that a most critical factor in the effectiveness of any organization, but especially military units, is the ability of the organization to sense changes in its external and internal environments, to internally process the information sensed, and to adapt its operations to the sensed changes. The ability of the organization to perform these functions is what is meant by "organizational competence."

It is further conceived that organizational competence is a major operational determinant of organizational effectiveness. Where effectiveness is the final outcome (mission accomplishment, productivity, etc.), competence is the ability of the organization to perform the critical operational functions (processes) that lead to achievement of

effectiveness. When the organizational processes that comprise competence are handled well, they enable a unit to cope with problems arising in its operational environments. When handled poorly, they may negate many of the positive effects contributed by efficiency in other areas of endeavor.

The ability of a unit to maintain organizational competence under the pressures of combat appears to be closely related to its ability to sustain effectiveness. If the organizational processes break down when the unit is subjected to external pressures, effectiveness will be impeded. On the other hand, if the processes continue to function adequately, effectiveness should be maintained or enhanced.

A major effort in Work Unit FORGE was to determine the contribution of competence to effectiveness and to specify the concrete activities of which competence is composed. To accomplish this goal, a theoretical framework was taken from Bennis (6) and adapted for use in the present study.

Bennis contended that "when organizations are viewed as 'open systems,' as adaptive structures coping with various environments, the most significant characteristic for understanding effectiveness is competence, mastery, or . . . problem solving" (6, p. 51). He then postulated three "ingredients of organizational health," which he suggested determine the competence of an organization. These ingredients—Adaptability, Reality Testing, and Identity—were described in the preceding chapter.

Bennis' concepts of Adaptability and Reality Testing were adopted as two components of competence. To these was added a third component, Integration, which was derived by the FORGE staff. Identity was not included as a component of competence because it appears to be related to social-psychological factors, whereas it can be shown that Adaptability, Reality Testing, and Integration have their bases in operational processes.

Thus, organizational competence is defined in terms of the following basic components:

(1) Reality Testing. Capacity to test the reality of situations facing the organization—the ability of the organization to search out, accurately perceive, and correctly interpret the properties and characteristics of its environments (both external and internal), particularly those properties that have relevance for the functioning of the organization.

(2) Adaptability. The capacity to solve problems arising from changing environmental demands and to act with effective flexibility in response to these changing demands.

(3) Integration. The maintenance of structure and function under stress, and a state of relations among sub-units that ensures that coordination is maintained and the various sub-units do not work at cross-purposes.

Taken together, these three components constitute organizational competence. It was hypothesized that the presence or absence of these components in appropriate degrees, both collectively and individually, would strongly influence the effectiveness of a military unit. It was further hypothesized that the ability of an organization to maintain adequate performance in each component while under pressure from external environments is critical to effectiveness.

CONCEPT OF ORGANIZATIONAL PROCESSES

In order to evaluate the competence of an organization, it was necessary to measure the components that comprise competence. Accordingly, the problem was to find a method for converting these broad components—Reality Testing, Adaptability, and Integration—into elements that would be susceptible of measurement.

Earlier in this report, Schein's Adaptive-Coping Cycle (9, pp. 98-99) was discussed. According to Schein, an organization responds to changes in either its external or internal environments in terms of a cycle of activities that enables it to adapt to the changes and to cope with them. The stages in Schein's Adaptive-Coping Cycle are:

(1) Sensing a change in the environment.
(2) Importing relevant information about environmental changes to those parts of the organization that can act upon it.
(3) Changing internal operations according to the information obtained.
(4) Stabilizing these internal changes in operations while preventing undesirable by-products that may result from changes in operations.
(5) Putting new or changed operations into effect in line with the originally perceived changes in the environment.
(6) Obtaining feedback on the successes or failures of the changed operations through further sensing of the external and internal environments.

It appeared that, with certain modifications, Schein's Adaptive-Coping Cycle encompasses most of the critical organizational processes that were the focus of this project, and that various of the stages in the cycle closely resemble several of the components hypothesized as comprising competence. In short, the cycle, with modifications, appeared to be a feasible basis for operationalizing organizational competence.

Accordingly, the following seven processes were derived from Schein's Adaptive-Coping Cycle to serve as bases for analyzing organizational competence:

(1) Sensing. The process by which the organization acquires information about the external and internal environments.
(2) Communicating Information. The process of transmitting information that is sensed to those parts of the organization that can act upon it.
(3) Decision Making. The process of making decisions concerning actions to be taken as a result of sensed information.
(4) Stabilizing. The process of taking actions to maintain internal stability and integration that might otherwise be disrupted as a consequence of actions taken to cope with changes in the organization's environments.
(5) Communicating Implementation. The process of transmitting decisions and decision-related orders and instructions to those parts of the organization that must implement them.
(6) Coping Actions. The process of executing actions against an environment (external or internal) as a consequence of an organizational decision.
(7) Feedback. The process of determining the results of a prior action through further sensing of the external and internal environments.

It is important to note that each of these organizational processes is related to one of the components of competence. The relationships are as follows:

Competence Component	Organizational Process
Reality Testing	Sensing, Communicating Information, Feedback
Adaptability	Decision Making, Communicating Implementation, Coping Actions
Integration	Stabilizing

Thus, each component of competence contains one or more organizational processes that can be measured and evaluated. Measurement and evaluation of process performance will be discussed in the next chapter.

Chapter 4

METHOD

FORGE I was designed to accomplish several broad research objectives:

(1) To determine the relationship between organizational competence and organizational effectiveness within infantry battalions.
(2) To evaluate the separate contributions of each of the components of competence and determine the relative contributions of the organizational processes used to operationalize the components.
(3) To determine the effects of environmental pressures upon competence and establish the relationship between effectiveness and the ability of an organization to maintain competence under pressure from its environments.
(4) To obtain certain descriptive data concerning the functioning of a battalion command and control system while it operates in a tactical environment.

To accomplish these objectives, it was necessary to observe and evaluate the activities of battalion command and control personnel as they performed in realistic tactical situations, evaluate the military effectiveness of the battalions, measure their performance on hypothesized organizational processes, and analyze the relationships between the measures of effectiveness and indices of competence, its components, and its processes.

THE DESIGN

The overall method was to simulate the activities of an infantry battalion engaged in a stability operation in Vietnam. The specific method of simulation was one-sided role playing, in which officer-subjects filled the roles of 12 key positions in the battalion. All inputs into the simulated battalion were made by experimenter-controllers in the roles of personnel at brigade, platoon, and adjacent unit levels. Through the use of preplanned and scheduled inputs, a dynamic and realistic situation was generated, which provided continual environmental changes and placed stringent requirements upon the simulated unit to make rapid and flexible organizational responses. All communications were monitored and these communications provided the data for analysis.

According to the research design, the simulated battalion was exposed to a series of events, extending over a period of approximately eight hours, to which it was required to respond. Although activities of the subjects were uninterrupted over the entire period, the simulate was designed in four administrative phases, three of which differed in the intensity of environmental pressure. "Pressure" was defined in terms of task load, as determined by frequency and complexity of inputs.

Each group of subjects participated for one and one-half days according to the following schedule of activities.

First Day		
1300 - 1500	Orientation	Brief subjects, administer personal data questionnaires, assign roles, practice use of communications system.

Second Day		
0800 - 0900	Phase I	Commander's Briefing.
0900 - 1115	Phase II	Low-Pressure Operations
1115 - 1330	Phase III	Moderate-Pressure Operations.
1330 - 1545	Phase IV	High-Pressure Operations.
1545 - 1700	Debriefing	Administer questionnaires, debrief subjects, discuss operations.

At an orientation meeting on the afternoon prior to participation in the simulation, each group was briefed on the general purpose of the study, role assignments were announced, and personal data about the subjects were collected. Each subject, according to his role assignment, was given a packet containing operations orders, situation analysis, strength reports, and other documents that provided him with sufficient background information on the simulated battalion to enable him to assume his role and realistically enter the situation as of 0800 hours on the following day. The subjects were informed that when play began the battalion would be in the second day of a tactical operation, that a new commander was assuming command of the battalion, and that they were to be prepared to brief the new commander on their respective situations at 0800 the next day. To familiarize the subjects with operation of the communications equipment, each group ran a "communications check" with players in their assigned positions.

Phase I began at 0800 on the following day and lasted for one hour. It consisted of briefings of the new battalion commander by the other members of the simulated organization. The purpose of this phase was twofold: (a) to provide a relatively uniform starting information base for all experimental groups, yet one whose depth in part depended upon the quality of interaction among the players (i.e., the quality of the briefings); and (b) to permit the organization to "shake down" before entering the tactical phases. The briefings allowed the players to interact and, thus, become somewhat familiar with each other under reasonably realistic conditions. This period also provided opportunity for the battalion commander to issue guidance to the other battalion members.

Beginning with Phase II, the simulate operated continuously to completion, with each phase lasting two hours and 15 minutes. Phase II was designed to be a "low-pressure" phase, Phase III was "moderate pressure", and Phase IV, the final one, was designed to provide high pressure through task overload. It was not intended to make Phase IV impossible to accomplish successfully, but rather to generate enough environmental pressure to permit discrimination between more and less competent groups.

The simulation was replicated 10 times, that is, it was conducted with 10 different groups of subjects. Thus, data were available on 10 simulated infantry battalions that were exposed to the same events, which occurred within identical time frames and sequences. This design made it possible to (a) measure competence across groups, (b) compare effectiveness between the groups, and (c) manipulate pressure through the use of phases that were equal in length but varied according to frequency and complexity of inputs.

THE SIMULATE

The "simulate" is the vehicle that was used to generate the performance to be studied. Within the limits of facilities and data-collection requirements, the simulate was designed to create a genuinely realistic environment that would elicit a high level of subject involvement and permit a maximum of spontaneity and interaction among the group members.

DEVELOPMENT OF SCENARIO

The purpose of the research was to study the functioning of infantry battalions in rapidly changing combat environments. To provide such an environment, a stability operation in the Republic of Vietnam was chosen as the vehicle for simulation, and it was decided that the simulate should be operated on "real time"—that is, the time frame within which simulated events were to occur would closely correspond to time required for actual events of similar nature in the real world.

Four Infantry captains who had participated in combat operations in Vietnam were asked to write detailed accounts of a number of events they had experienced firsthand and considered to be typical of stability operations. Each account contained descriptions of the locale, physical environment, circumstances leading to the event, personnel involved, and the outcome. To insure that all of the functions of the simulated battalion would be included, each officer was assigned responsibility for a different subsystem—Personnel, Intelligence, Operations, or Logistics. In this way, there could be assurance that all subsystems of the simulated battalion could be challenged with problems that were both relevant and realistic. Descriptions of over 100 events were thus made available to the research staff.

A HumRRO staff member experienced in battalion combat operations then prepared a scenario that incorporated the various events into the available time frame in a logical and realistic sequence. The scenario concerned the activities of a light-infantry battalion, Task Force (TF) 1-66, engaged in stability operations in one of the northern provinces of the Republic of Vietnam. The simulate began at 0830 (simulate time) on 19 March, the second day of a search and destroy operation in which TF 1-66 was engaged with other elements of 1st Infantry Brigade, 21st Infantry Division. A summary outline of the scenario appears in Appendix A.

CONTROL OF INPUTS

The simulate was activated and major directions were controlled by Brigade Operations Orders. Continuous action was maintained and minute-by-minute control was exercised by inputs from controllers.

Early in an initial exploratory study, it had been recognized that an organizational simulation is a highly complex situation that requires careful planning, if control is to be exercised and data are to be efficiently recovered. Accordingly, a method for controlling inputs and for recovering data was developed. The method is based upon the concept of a *probe*. A probe is a problem which is designed to stimulate a particular subsystem of the organization and through which data can be recovered separate from that concerned with other probes. Thus, probes can be planned to challenge all the different subsystems and to cover a wide spectrum of problems and activities.

Operationally, a probe is a set of inputs consisting of one or more messages designed to provide information about the problem or to stimulate action by the organization concerning the problem. A single input about a probe is a *probe element*. In FORGE, probes consisted of from 1 to 50 probe elements. Taken together, probe elements concerning a single probe make up a pattern of information about the problem. However, elements pertaining to a single probe can be inserted at different points in the organization, at different times, and by different sources; they possess an unfolding quality that requires the organization to assemble, and properly interpret, all of the information about a probe before it can act correctly.

Except for a small number of contingent inputs, all probe elements in the FORGE simulate were scheduled to be inserted in the same numbers and at the same times for all

experimental groups. This method ensured that all groups were exposed to the same experiences and, therefore, that data would be comparable across groups.

The source of controller activity was a Probe Manual, which contained all inputs to be inserted by each controller. In the manual, each probe element appeared on a separate page that also contained identifying information, time to be inserted, insertion instructions, anticipated recipient actions, and subsequent controller responsibility for reacting to spontaneous inquiries or actions by players. Appendix B shows a set of probe elements pertaining to one probe, as they appeared in the Probe Manual.

The scenario was designed to present 128 interlocking probes, containing 376 probe elements. In multiple-element probes, time from introduction of the first input to insertion of the last element for a single probe varied from several minutes to over three hours. Furthermore, elements pertaining to a single probe could be inserted by several controllers into different points within the simulated battalion, thus requiring considerable communication among players before a complete and accurate view of the problem could be achieved. Since probes varied in numbers of elements and in lapsed time for completion of scheduled inputs, each group worked on numerous probes concurrently. Once inputs were inserted, players were free to react spontaneously—to handle the problems in any way they chose. The research staff made no attempts to control player responses or to influence problem situations.

Design of the scenario on the basis of probes made it possible to control all inputs according to a planned schedule and ensured that all experimental groups were exposed to identical environmental conditions. Equally important, probes were also the basis for data recovery, to be discussed in a later section.

MANIPULATION OF PRESSURE

The research design included a requirement for exposing participants to different degrees of environmental pressure in the three operational phases of the simulate. Pressure was defined as "situational demands requiring immediate attention of participants." To manipulate pressure according to the design, three input characteristics were varied across phases: (a) frequency of inputs to which players were required to respond, (b) complexity of probes, in terms of number of elements comprising a probe, and (c) importance of probes for mission accomplishment and unit survival.

Thus, in Phase II (low pressure) the scenario involved a slow-moving, routine patrolling operation, with a low rate of input from controllers and relatively uncomplicated probes, many of which were not critical for accomplishment of the battalion's mission. On the other hand, Phase III (moderate pressure) began with a radical change in mission, continued with a requirement for final planning and execution of an air assault within a short time span, and included both more frequent and more complex inputs and more important probes. Finally, Phase IV (high pressure) involved intense combat with an enemy force, with a high frequency of inputs and a majority of problems that were both complex and critical for survival of the unit.

Frequency and complexity were manipulated by varying the rate of controller inputs and the number of elements per probe across phases. As the simulated combat operation proceeded across phases, players were required to cope with increasing numbers of messages, hence more information, and with problems that required increasing coordination both between messages and between players.

Probe importance was included as an aspect of pressure because it was concluded that participants would experience greater pressure with increasing criticality of the problems for accomplishment of the mission and for unit survival. To manipulate probe importance, a greater number of increasingly critical probes was inserted within each

successive phase. The importance of probes was determined by expert judgment. Prior to development of the simulate, three military experts (retired field-grade officers) rated each candidate probe on a seven-point scale of importance for mission accomplishment. Probes judged to be "of little importance for mission accomplishment" were given a weight of one, and those judged to be "of maximal importance for mission accomplishment" were given a weight of seven. Mean ratings, rounded to the nearest whole number, were designated as "probe weights." Each candidate probe was assigned a "probe weight" that indicated the importance of that probe for mission accomplishment. For each phase, probes were selected for inclusion in the scenario so that—within the bounds of realism—average probe weight for the phase contributed appropriately to low, moderate, or high pressure.

Table 1 shows input characteristics for the simulate.

Table 1

Characteristics of Simulate Inputs

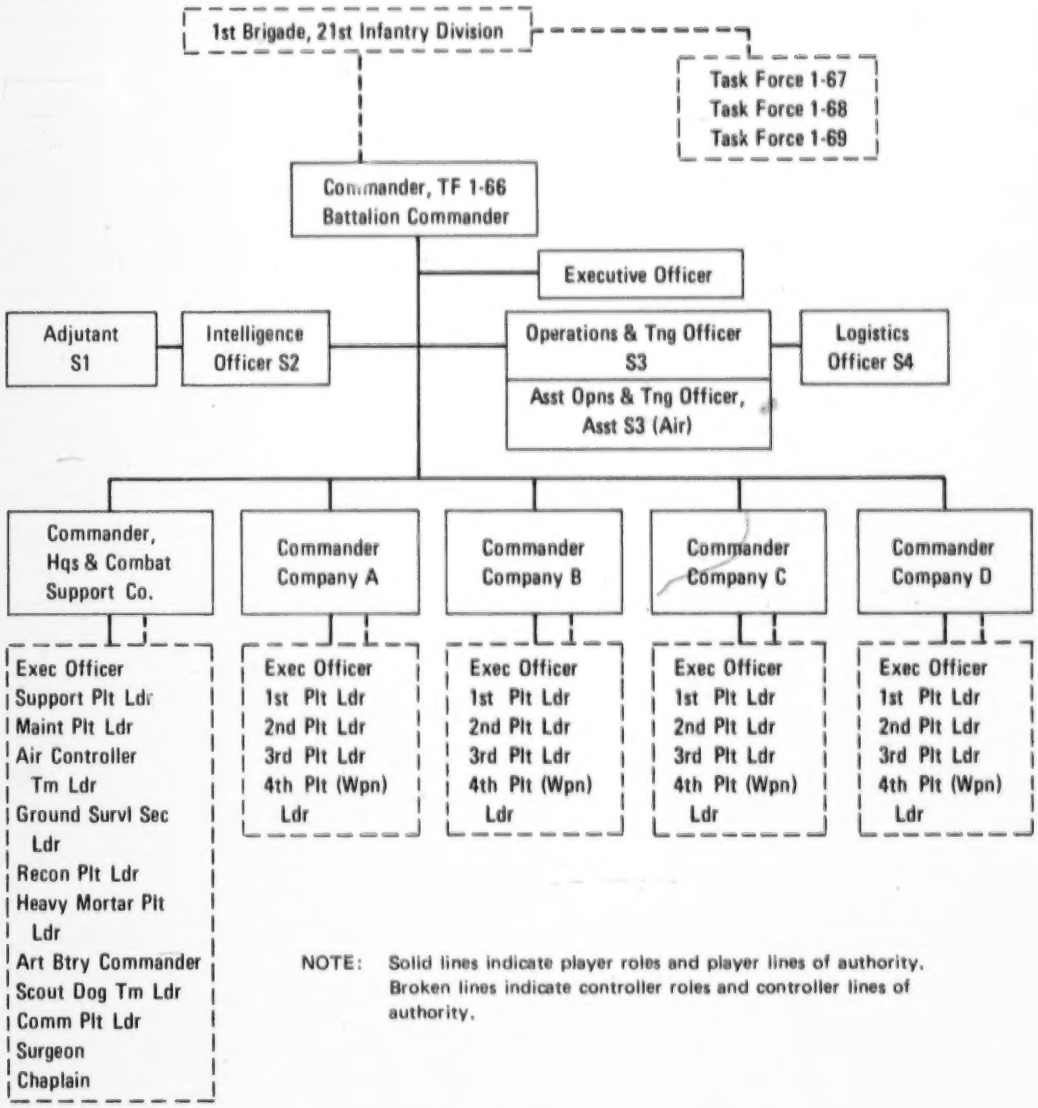
Input Characteristics	Phase			Simulate
	II	III	IV	
Probes	51	31	46	128
Probe Elements	77	91	208	376
Probe Complexity (N probe elements/ N probes)	1.5	2.9	4.5	2.9
Input Rate (N probe elements/minutes)	.6	.7	1.5	.9
Mean Probe Weight	2.4	3.7	4.4	3.5

THE SIMULATED ORGANIZATION

Figure 1 shows the simulated organization and indicates those levels and units occupied by players and controllers respectively. Task Force 1-66, the simulated unit, functioned as one element of the 1st Brigade, 21st Infantry Division. The brigade consisted of four task forces operating in adjacent sectors. The simulated task force consisted of 1st Battalion, 66th Infantry and attached artillery, engineer, and scout dog units. The unit was organized into a battalion command and control center, a combined Headquarters and Combat Support Company, and four maneuver companies, A, B, C, and D. Units attached to the battalion operated under the control of the Commander, Headquarters and Combat Support Company.

Experimental subjects, called "players," were assigned to the following positions: Battalion Commander; Battalion Executive Officer; Adjutant (S1); Intelligence Officer (S2); Operations and Training Officer (S3); Assistant Operations and Training Officer (Air) (S3); Commander, Headquarters and Combat Support Company; Commander, Company A; Commander, Company B; Commander, Company C; and Commander, Company D. Experimenter-controllers performed both brigade-level and adjacent unit roles, and those roles subordinate to company commanders.

Organization of the Simulated Battalion



NOTE: Solid lines indicate player roles and player lines of authority. Broken lines indicate controller roles and controller lines of authority.

Figure 1

THE COMMUNICATIONS SYSTEM

Players could communicate in any manner that was consistent with Army procedure and with the simulated physical positioning of the various units. Available modes of communication were face-to-face, written message, and radio. Players within the battalion headquarters could communicate either face-to-face or by written message. Because Task Force 1-66 was depicted in the scenario as physically removed from brigade headquarters, communication between brigade controllers and battalion players was by radio and written message only. The simulated tactical disposition of companies and platoons also

prevented face-to-face contact between company commanders and either battalion-level player personnel or platoon controllers. Therefore, communication between these levels was by radio and written message. Because of the nature of the tactical operation in which the simulated battalion was engaged, most communications between levels occurred by radio.

The communications system included nine simulated radio nets. The nets were: Brigade Command, Operations, and Intelligence Net; Brigade Administrative-Logistics Net; Battalion Command, Operations, and Intelligence Net; Battalion Administrative-Logistics Net; and five company nets. The various radio nets are shown schematically in Appendix C. Additional radio nets that may be used in genuine tactical situations were deleted from the simulation (a) to reduce numbers of controllers that would be required and (b) to permit monitoring of all communications by the research staff. Communications that might have been transmitted over additional nets were sent over the appropriate command, operations, and intelligence nets. For example, requests for tactical air support and indirect fire support were transmitted through command channels rather than directly to air or fire support centers.

Communication by radio was simulated by field telephones augmented by loudspeakers. Each station on a radio net was equipped with a field telephone connected to that net and a loudspeaker that transmitted all traffic that occurred on that net. Thus, the participant could transmit messages over the net and could also monitor all traffic on it, exactly as if he were equipped with a conventional radio receiver and transmitter. Players in the battalion headquarters operated on both brigade and battalion nets, whereas players who were company commanders operated on the two battalion nets and their respective company nets. Standard Army radio procedures were used. Simulation by the use of telephones and loudspeakers made it possible to achieve the realism of radio while maintaining the reliability of wire communication. Furthermore, tape recorders could be connected to the wire nets, enabling the research staff to monitor and transcribe all radio conversations.

OPERATION OF THE SIMULATE

The simulate was operated by seven experimenter-controllers and a small support staff of messengers and tape-recorder operators. The controller staff consisted of two "brigade controllers," one of whom was also Chief Controller, and five "company controllers."

One brigade controller, playing appropriate roles, transmitted all messages to participants in the Brigade Command, Operations, and Intelligence Radio Net (Bn Co, S2, and S3), and a second brigade controller transmitted all messages to participants in the Brigade Administrative-Logistics Radio Net (Bn Executive Officer, S1, and S4). In a similar way, each respective company controller communicated on the radio net of the company for which he was responsible, while playing the roles of all personnel subordinate to the player-commander of the company.

Accordingly, controllers played the roles of all personnel and organizational levels with which the members of a battalion command group would typically interact. Controllers provided inputs according to the planned schedule and reacted to communications from players in accordance with supplemental situational data that had been provided to them.

The two brigade controllers were combat-experienced, retired, field-grade, Army Infantry Officers who were members of the HumRRO research staff. The company controllers were active-duty senior Army captains and majors, all of whom had experienced combat in Vietnam as company commanders and staff officers and were recent

graduates of the Infantry Officer's Advanced Course at the U.S. Army Infantry School. The experience and training of these individuals enabled them to provide a high degree of realism to the simulation.

Prior to the conduct of the simulation, all controllers attended a five-day "controller school" conducted by the work unit leader and the chief controller, who had developed the simulate. During these sessions, controllers were instructed concerning the simulation, its purposes, and operation of the communication system. However, the major portion of time was spent in practicing the inputs, examining potential reactions of subjects, and planning contingent responses to subjects' reactions and inquiries. Training was completed with a "full-dress" pilot administration of the simulation to a group of subjects who were fully comparable to those who would participate in the actual research simulations.

Appendix D shows the layout of the experimental area and placement of players and controllers.

SUBJECTS

CHARACTERISTICS OF SUBJECTS

Experimental subjects were 120 Vietnam-experienced Infantry officers, ranging in grade from senior major to first lieutenant. They participated in 10 groups of 12 men each, thus providing for 10 replications of the simulations.

Subjects were randomly selected, within the restrictions stated below, from non-student officers stationed at Fort Benning, Georgia. For the selection of personnel to participate as players, it was specified that all participants should be Infantry officers who had served in Vietnam, and that each group should consist of at least one major and not more than four first lieutenants. Second lieutenants were not accepted. Table 2 summarizes characteristics of the experimental subjects.

Table 2

Characteristics of Experimental Subjects

Rank	N	Age (Mean Years)	Length of Service[a] (Mean Years)	Combat Experience[b]		
				Bragade or Battalion Staff	Company Commander (N)	Platoon Leader (N)
Major	12	31.7	9.9	9	9	2
Captain	78	27.8	8.6	35	54	46
1st Lieutenant	30	26.3	6.0	8	7	17

[a]Includes enlisted service.

[b]Number of subjects with various types of combat experience exceeds total number of subjects because some individuals reported service in more than one position.

ASSIGNMENT TO ROLES

At the beginning of the orientation briefing, each officer completed a questionnaire in which he supplied information concerning time in service and in rank, current and previous assignments, and schools attended. Roles were assigned on the basis of the questionnaire responses.

Within each group, the senior officer was assigned the role of battalion commander. Accordingly, the 10 battalion commanders were majors, nine of whom had served on brigade or battalion staffs in Vietnam.

Wherever possible, players were assigned to battalion staff roles on the basis of prior experience related to the position. In approximately 90% of the cases, players in these roles had prior experience as principals or assistant staff officers in the relevant activity. In the remaining 10%, the roles were assumed by officers who reported prior staff experience but in a different staff section. One of the more senior officers in each group was assigned the role of battalion executive officer. After battalion command and staff positions were filled, the remaining officers were assigned as company commanders.

DATA COLLECTION

The bases for all data were (a) players' ratings of realism, involvement, and pressure experienced during the simulation and (b) all communications of members of the simulated battalions. The total duration of FORGE I ran from 1968 to 1971, but data were collected within a three-week period in June 1969.

PLAYERS' RATINGS

At the beginning of the debriefing session that followed the conclusion of the simulation, all players completed an extensive questionnaire designed to measure various social-psychological attributes of the experimental groups. The results of that measurement effort will be described in a later report.

Also included in the questionnaire were items to obtain players' reports on how much realism, involvement, and pressure they experienced, as well as their judgments of the predictive value of the simulation. These items are shown in Appendix E. Data from these items would permit an evaluation of the extent to which realism, involvement, and pressure had actually been generated according to the research design.

COMMUNICATION IN THE SIMULATION

Communication within each simulated organization could be accomplished by written message, simulated radio, and face-to-face conversation. Since communication in these modes was monitored continuously, a complete record of all communication was available for each of the 10 experimental groups.

For written messages, players were provided with printed, preassembled message forms in triplicate. Players completed the forms, retained one copy, and transmitted the remaining two copies by messenger. Messages were delivered to a central message center where they were registered; one copy was retained and the other was transmitted to the recipient. The retained copy was filed for data purposes.

Simulated radio communications were tape recorded. A tape recorder was linked to each of the nine telephone systems simulating radio nets. Traffic on the nets was continuously recorded during the three operational phases of the simulation.

Face-to-face communication was also tape recorded. The battalion commander, the battalion executive officer, and the five staff officers wore standard Army helmet liners to which microphones were attached. Each microphone was connected to a small FM transmitter attached to the side of the helmet liner. Each microphone transmitted on a separate standard FM broadcast frequency to a centrally located FM receiver that, in turn, was linked to a tape recorder. Microphones were sufficiently sensitive so that the voices of all participants in a conversation were simultaneously recorded on all of their tapes, in most instances. Since the scenario required that all company operations occur at some distance from battalion headquarters and separate from each other, each player who was a company commander was physically segregated from all other personnel. Face-to-face communication for these individuals would have been unrealistic and did not occur. Therefore, company commanders were not equipped with microphones and transmitters.

Sixteen tape-recording channels were required to monitor the nine radio nets and seven face-to-face transmissions. For all tapes on which controllers did not participate (face-to-face; Battalion Command, Operations, and Intelligence Net; and Battalion Administrative-Logistics Net), a time signal in minutes was superimposed. In all transmissions by controllers, the transmission was opened with a reporting of simulate time. Thus, all tapes contained means for determining the time at which each communication occurred. Recorders operated continuously throughout the operational phases of the simulation and generated 108 hours of tape per group. For the 10 groups, 1,080 hours of tape recordings were available for transcription, reduction, and analysis.

The recorded communications were the basis for analyses of organizational competence, organizational effectiveness, and communication patterns within the experimental groups.

DATA REDUCTION

As discussed previously, the sources of data were (a) players' ratings of realism, involvement, and pressure, and (b) tape-recorded and written communications of each experimental group. Reduction of these products to quantitative data required procedures for (a) assigning numerical values to players' ratings, (b) classifying the communications according to a set of systematically derived categories, (c) evaluating the communications in accordance with the conceptual framework, (d) determining the outcome for each probe by analysis of the communications, and (e) evaluating the effectiveness of each outcome.

PLAYERS' RATINGS

For each questionnaire item concerned with realism, involvement, and experienced pressure, alternative responses from which players could choose were arranged on a scale in order of increasing intensity. Values were assigned to alternatives, with lower values indicating very little and higher values more of the attribute under consideration. Appendix E shows the values assigned to the alternatives.

For each item, summing of the response values for all subjects (N = 120) permitted computation of various descriptive statistics that would reflect the extent to which the simulation was successful in creating the desired effects in the actual experiences of the subjects.

TREATMENT OF COMMUNICATIONS DATA

Reduction of communications data involved transcribing the written and tape-recorded communications of each group, developing "probe manuscripts" containing all communications by a group pertaining to each probe, and analyzing the manuscripts to evaluate competence and effectiveness of each group.

In the first step, typists listened to each recording tape and typed a verbatim transcript of all communications on it, identifying the tape, the time of occurrence, and the sender and recipient of the communication when possible. They transcribed written messages in a similar fashion. For each group, the result was verbatim transcripts of all radio, face-to-face, and written messages. After typing, members of the research staff checked each transcript against the tape or written messages to ensure accuracy.

In addition to its value for design of the simulate, the probe concept was essential for meaningful recovery of data. Using probes, it was possible to relate most communications to specific problem inputs and, thus, to obtain accounts of the way in which each probe was handled by each group. This was accomplished by developing the "probe manuscripts." Members of the research staff scrutinized each typed transcript, and, for each communication unit, identified the probe to which it pertained and noted this in the margin of the transcript. It was found that less than 2% of all communication units did not refer to any probe. Many conversations dealt with more than one probe, but it was always possible to apportion parts of the communications to their respective probes and recover all of the material.

All communications referring to each probe were extracted from the transcripts and assembled, by time sequence, into probe manuscripts, which contained all of the communication performed by a particular group concerning a specific probe. The result was 128 probe manuscripts for each experimental group. Examples of probe manuscripts are shown in Appendix F.

With the development of probe manuscripts that contained all communications from initial input to final response, it became possible to evaluate the performance of a simulated organization in terms of both (a) its competence as defined by the processes included in the Adaptive-Coping Cycle and (b) its military effectiveness.

ANALYSIS OF COMPETENCE

The analysis of organizational competence included (a) performance of a content analysis of each unit of communication; (b) evaluation of each unit in terms of how well the process represented by it was performed, and, finally, (c) the development of group scores for each process, each competence component, and competence.

Content Analysis. A system of procedures was devised to code each item of communication according to a set of categories that described the item and identified the organizational function (process) it served. Excerpts from a Coder's Handbook, including an overview of the system, a score sheet, a coding key, and a summary list of criteria for process coding, appear in Appendix G. All appropriate columns on the score sheet were coded except Column R, Process Value, which was completed in a later step. The set of scoring categories[1] consisted of four subsets:

I. Contact Categories

A *contact* was defined as the material contained between two points in a transcript where a single communication event began and ended. Contact Categories were:

[1] Capital letters preceding titles of the categories coincide with columns on the score sheet in Appendix G.

A. Contact Number
B. Beginning Time of Contact
C. Lapsed Time of Contact
D. Contact Initiator
E. Contact Recipient(s)

II. Identification Categories

These categories identified and described the basic coding units. A *unit* was defined as the material contained within one contact where a single probe is the continuous topic. Many contacts contained more than one unit, because more than one probe could be discussed in a single communication event. Identification Categories were:

F. Unit Number
G. Sub-Unit Number
H. Beginning Time of Unit
I. Lapsed Time of Unit
J. Mode of Communication (radio, written, face-to-face)
K. Unit Initiator
L. Unit Recipient(s)

III. Content Categories

These categories identified the content of the coding unit.

M. Unit Topic (identified topics such as enemy, terrain, personnel, logistics, etc.)
N. Focal Time of Unit (past, present, or future)
O. Topic Location (internal or external environment)

IV. Process Categories

These categories classified and evaluated the coding unit according to sub-classes of processes that were performed.

P. Process (classified the unit or sub-unit according to the sub-process that was performed)
Q. Decision, Command, Order, or Instruction Follow-Up (used to key actions to the decisions from which they derive)
R. Process Value (scores reflecting quality of sub-process performance)

Coders examined and classified each item of communication, completing a separate score sheet for each probe. For each group, the result was a set of 128 score sheets describing each unit of communication in terms of 18 categories that encompassed all aspects of the communication considered relevant for this study. The purpose was to obtain data that, primarily, would enable a test of the conceptual framework but, in addition, would be sufficiently comprehensive to permit further analysis of communication patterns within battalions, if that became desirable. For these reasons, coding was not limited to factors related to competence, but also included material that would describe many aspects of military communication.

Process Coding. Of special relevance for tests of the conceptual framework is the procedure for classifying communications according to their process functions. Initially, it was planned to code each item of communication according to which one among the seven broad processes postulated in the conceptual framework had been performed in that unit. Under this plan, only one process would be encompassed within each single communication unit.

However, as the coding system was refined, two facts became apparent. First, more than one process could be performed within a single coding unit. For example, within one unit (communication material in which one probe is the continuous topic) a company commander might sense information from a controller-platoon leader, make an on-the-spot decision, and issue an order that constituted a coping action; the unit thus

contained three separate processes—sensing, decision making, and coping action. Accordingly, a procedure was added to permit multiple-coding of units, where required, by recording "sub-units." Whenever more than one process occurred within a coding unit, each was recorded as a sub-unit and was coded separately in the "Process" column.

Second, within most of the seven processes several discriminable types could be identified. It was concluded that differentiation between these types would both enhance accuracy of coding and permit a more sensitive analysis of process performance. Accordingly, the *sub-process* was introduced as the basic unit to be used in coding and evaluating process performance. Following is a list of the seven processes and their sub-processes.

(1) Sensing
- Passive Sensing
- Active Sensing
- Sensing Action
- Sensing of Brigade Decision
- Sensing of Platoon Recommendation

(2) Communicating Information
- Communicating Information Sensed
- Communicating Information, Discussion, and Interpretation
- Communicating Recommendations

(3) Decision Making
- Decision Leading to Active Sensing
- Decision Leading to Sensing Action
- Decision Leading to Stabilizing Action
- Decision Leading to Coping Action
- Decision Leading to Feedback Action
- Decision to Rescind a Previous Decision

(4) Stabilizing
- Stabilizing Action

(5) Communicating Implementation
- Communicating Implementation About Decisions
- Communicating Implementation, Discussion, and Interpretation

(6) Coping Action
- Coping Action

(7) Feedback
- Feedback Action

In Column P of the scoresheet (Appendix G), coders classified each coding unit in terms of the sub-process or sub-processes performed within it. Definitions of the sub-processes appear in Appendix G.

Reliability of Content Analysis. The system of content analysis was conceived in the initial exploratory study which preceded Work Unit FORGE, and was developed, refined, and evaluated during analysis of the communications of four groups that participated in a test simulate during the study. When three coders, working without carefully articulated coding criteria, used the system to independently code four probe manuscripts (approximately 200 units of communication), they agreed on 76% of the units scored. This percentage of agreement is better than those reported in most descriptions of content analysis systems.

To further improve reliability, four refinements were added:

First, clear-cut criteria for coding sub-processes were developed (see Appendix G).

Second, a Coder's Handbook was prepared. This handbook is a comprehensive (99 page) description and discussion of the coding system, with guidelines, samples, and decision rules. Although the samples are specific to battalion operations, the remainder of the handbook provides coding guidance appropriate for content analysis of communication generated by most types of organizational simulations. The materials in Appendix G are selected sections of the handbook.

Third, the Coder's Handbook served as the basis for an intensive program of training for coders, including both formal instruction and practical exercises in which the exploratory study's transcripts were used. Coders were three enlisted psychologists (M.A. degree) who were members of the U.S. Army Infantry Human Research Unit and were assigned to Work Unit FORGE as research assistants.

Finally, a quality control system was installed. Material to be coded was processed in lots. After coding, each lot of material was sampled and examined by the Work Unit Leader. If, in his judgment, more than 10% errors were found within a sample, the entire lot was rejected and recoded.

Because of these added refinements, it is estimated that accuracy and reliability of coding were improved much beyond the 76% agreement achieved in the exploratory study.

Process Evaluation. The system of content analysis that has been described is a method for classifying units of communication according to a set of defined categories. Like all schemes for analyzing content, it provided information concerning frequency of occurrence of the several sub-processes. It was then possible to perform various occupational procedures in which frequency and rate of occurrence were the basic elements for analysis. This is the almost universal practice in research efforts where content analysis has been used to study organizational or group performance and, accordingly, most such studies have been limited to analyses involving frequency and rate.

In Work Unit FORGE, analyses that involved frequency and rate of organizational processes were essential and were performed. However, as a determinant of organizational effectiveness, *quality of process performance* was deemed to be equally, if not more, important than frequency or rate. Accordingly, quality—how well the processes were performed—was also evaluated.

During the content analysis, each unit of communication was coded to indicate the organizational sub-process it served. After coding was completed, a military expert, who had not performed any coding activities, assigned a "sub-process value" to each unit. He read the unit, noted the sub-process code assigned, and, using criteria appropriate for that sub-process, evaluated the quality of performance and assigned a sub-process value according to the scale described below. Thus, classification of sub-processes and scoring of them were two separate operations, performed independently by different individuals. This procedure was used to reduce bias in evaluation.

The following scale was used to assign values to sub-processes: Poor, 10; Marginal, 20; Adequate, 30; Excellent, 40. Values were assigned on the basis of the quality of the sub-processes and not their effectiveness. That is, evaluation was in terms of how well the sub-process was performed, regardless of its ultimate effect upon subsequent processes or upon the outcome of the probe.

In evaluation, the following factors were considered to be pertinent for the sub-processes:

(1) Sensing
   (a) Accuracy—Includes both accurate detection and correct interpretation of information.
   (b) Relevance—In the initiation of Active Sensing or Sensing Action, is the attempt to obtain information relevant to the mission, task, or problem?

(2) Communicating Information
   (a) Adequacy—Includes both accurate transmission of available information and sufficient completeness to transmit full and adequate understanding to the receiver.

(b) Appropriateness—Includes consideration of (1) timing appropriate to requirements, (2) correct choice of recipients, and (3) whether the message should have been communicated.

(3) Decision Making

(a) Adequacy—Was the decision adequately correct in view of circumstances and available information?

(b) Appropriateness—Was the decision timely in view of the information available to the decision maker?

(c) Completeness—Did the decision take into account all or most contingencies, alternatives, and possibilities?

(4) Communicating Implementation

(a) Adequacy—Includes (1) accurate transmission of implementation instructions in view of orders, decisions, or information available to the sender, and (2) completeness sufficient to transmit adequate and full understanding to the receiver.

(b) Appropriateness—Includes (1) timing, (2) correct choice of recipients, and (3) whether the message should have been communicated.

(5) Actions: Stabilizing, Coping, and Feedback

(a) Adequacy—Was the action correct in view of the operational situation and the decision or order from which the action derived?

(b) Appropriateness—Was timing of the action appropriate in view of the situation and the decision or order from which the action derived? Was choice of recipient of the action appropriate?

(c) Completeness—Even though basically correct, did the action fully implement the decision from which it derived or fully meet the requirements of the situation?

The evaluator used these criteria for determining the proper placement of each unit upon a scale of values ranging from 10 to 40, in increments of 10 points. During development of the scoring system, it was recognized that a four-point scale usually allows only gross discriminations between single responses. However, in the exploratory study, scorers encountered difficulty in evaluating sub-processes when they were required to use scales of more than four points. Since each run of the simulation was expected to yield a large number of communication units, it was concluded that a sufficient number of scores would be available within each process category to permit discrimination between groups, if differences did, in fact, exist. Accordingly, the scoring system described above was adopted.

Development of Scores. Sub-process values were the basic units from which group scores for the different aspects of competence performance were derived. For each probe, phase, and the entire simulate, scores were computed for sub-processes, processes, competence components, and competence. Following are procedures used in development of the various scores:

(1) Probe Sub-Process Score. A Probe Sub-Process Score is the mean of sub-process values (spv) for a given sub-process on a given probe—for example, the mean of all sub-process values for Passive Sensing that were performed by Group No. 1 on Probe No. 1. Since group responses to probes were spontaneous, and therefore were free to vary, frequencies of each sub-process within each probe differed among groups. To prevent over-weighting for frequency and, thus, to insure comparability of quality of process performance, probe mean sub-process values were designated Probe Sub-Process Scores. The result was a Probe Sub-Process Score for each sub-process (19) on each probe. Since all sub-processes did not occur in every probe manuscript, some probes produced scores of zero for certain sub-processes.

(2) Higher-Order Scores. Process Scores were computed for each of the seven processes outlined in the conceptual framework by summing scores of all sub-processes within the respective processes. In a similar fashion, Competence Component Scores are sums of the appropriate Process Scores. Competence Scores are obtained by summing scores for the three Competence Components.

(3) Probe, Phase, and Simulate Scores. The research design provided for computation of the above-described scores for probes, phases, and the entire simulate. For each aspect of competence, a score for each phase was obtained by summing relevant probe scores within the phase, and simulate scores were sums of scores for the three phases.

Table 3 summarizes computation procedures for the various scores.

Table 3

Developed Score Computation Procedures

Unit	Sub-Process Score (N = 19)	Process Score (N = 7)	Competence Component Score (N = 3)	Competence Score (N = 1)
Probe (N = 128)	Mean Sub-Process Values	Sum of Probe Sub-Process Scores	Sum of Probe Process Scores	Sum of Probe Competence Component Scores
Phase (N = 3)	Sum of Probe Sub-Process Scores	Sum of Phase Sub-Process Scores	Sum of Phase Process Scores	Sum of Phase Competence Component Scores
Simulate (N = 1)	Sum of Phase Sub-Process Scores	Sum of Phase Process Scores	Sum of Phase Competence Component Scores	Sum of Phase Competence Scores

ANALYSIS OF EFFECTIVENESS

Military effectiveness is difficult to evaluate objectively because of factors, either fortuitous or enemy-contrived, that may intervene to influence the outcome of a combat operation. Certainly, in a simulation of the nature and complexity of the one reported here, the evaluation of effectiveness must eventually rest upon expert judgment. Since some bias is inherent in all judgment, the following procedures were designed to reduce bias insofar as possible and to result in accurate evaluations of the military effectiveness of the various experimental groups.

Development of Effectiveness Criteria. After completion of the controllers' school and the pilot simulation, but prior to conduct of the simulation with experimental groups, each of the seven controllers independently developed a set of possible outcomes for each probe, according to the following instructions:

(1) In the enclosed packet is a brief summary and a list of the inputs for each of the 128 probes in the simulate.

(2) Carefully analyze each probe separately. For each probe, think of all possible outcomes, both effective and ineffective, that might occur. Emphasis is upon "outcomes." You are not to look into the "black box" of the organization, i.e., you should not be concerned with processes, procedures, or ways the organization might use to arrive at an eventual result. You are only to be concerned with what might come out of the "black box"—with end results only. List all of the outcomes that might result, to include erroneous or "wrong" outcomes. Remember that "no action taken" is an outcome and should be included.

(3) After you have listed all possible outcomes for a probe, assign to each outcome the descriptor that best describes your evaluation of it in terms of its effectiveness for resolving the problem posed by the probe and for contributing to overall mission accomplishment. Assign one of the following descriptors to each of the outcomes you have derived:

(a) Highly Satisfactory.
(b) Satisfactory.
(c) Marginal.
(d) Unsatisfactory.
(e) Highly Unsatisfactory.

(4) After all controllers have developed their lists of outcomes and evaluations for all probes, you will meet together and decide upon a final list that represents the consensus of the entire group.

Although approximately 24 hours of work were required for development of the final group product, a surprisingly small number of initial differences concerning the substantive content of potential outcomes were found among the seven individuals. Most of the time and effort was devoted to reconciling differences in wording and to resolving questions concerning the assignment of descriptors to outcomes that were judged to fall in the middle range of the scale.

The result, for each probe, was a set of outcomes and descriptors that was the consensus among seven individuals who were both combat-experienced Army officers and intimately familiar with the simulate. Because of the specific nature of the problems, probes were not assigned equal numbers of outcomes and no attempt was made to assign outcomes and evaluations that would cover the full range of the descriptor scale. Thus, because of their different contents, one probe might be assigned only two possible outcomes, another might have four, while a third would have eight.

Furthermore, no attempt was made to balance favorable and unfavorable sides of the descriptor scale. The outcomes for the first probe might be judged Satisfactory and Unsatisfactory, while four outcomes of the second could be rated Highly Satisfactory, Satisfactory, Marginal, and Highly Unsatisfactory. In short, no attempt was made to force raters to balance their evaluations of the outcomes, with the exception that there must always be at least two outcomes—one favorable and one unfavorable.

This set of potential outcomes, with their descriptors, served as criteria for evaluating the military effectiveness of the experimental groups.

Evaluation of Effectiveness. To evaluate effectiveness, probe manuscripts of the experimental groups were analyzed by a military expert (retired field-grade officer) who had not participated in development of the outcomes. This individual read each probe manuscript and identified the outcome that had actually resulted. Then, he compared the actual result for the probe against the list of potential outcomes that had been developed by the controllers. From the list, he selected the outcome that matched the actual result and identified the descriptor that had been assigned the outcome by the controllers. The descriptor was converted to a "Probe Effectiveness Score" according to the following point scale: Highly Satisfactory, 50; Satisfactory, 40; Marginal, 30; Unsatisfactory, 20; Highly Unsatisfactory, 10.

In all instances in which an actual result matched a potential outcome, the evaluator was required to assign a score appropriate to the previously determined descriptor for the outcome. Of 1,280 probe manuscripts (128 each for 10 groups) thus evaluated, 22 resulted in outcomes that had not been previously anticipated by the controller groups. For these 22 probe manuscripts, Probe Effectiveness Scores were assigned by the evaluator.

Thus, rater bias was minimized by the development of criteria independent of the evaluator, and by the requirement that the evaluator assign scores based on the previously determined outcomes. For each group, the result was a Probe Effectiveness Score for each of the 128 probes. These scores served as the basic units from which phase and simulate effectiveness scores could be developed. A group's Phase Effectiveness Scores were the sums of the Probe Effectiveness Scores within the respective phases, and the Simulate Effectiveness Scores were the sum of the three Phase Effectiveness Scores.

Chapter 5

RESULTS

The presentation of results will address a number of issues pertinent to evaluation of the simulation and to the research objectives. First, data concerning participants' reports of interest, involvement, realism, and perceived pressure will be presented as evidence of face validity of the simulation procedures. Second, activities of the simulated organizations will be summarized. Finally, results that pertain to the conceptual issues will be discussed.

VALIDITY OF THE SIMULATION

AUTHENTICITY, INTEREST, AND INVOLVEMENT

Players' ratings on Questionnaire Items 1, 2, 3, and 4 (Appendix E) provided measures of authenticity of the simulation and the extent to which participants were interested, involved, and motivated. The values shown in Appendix E were assigned to the respective ratings, and means and standard deviations for all players as a group (N = 120) were computed. Table 4 summarizes players' ratings for the four items.

Table 4

Player Evaluation of the Simulation

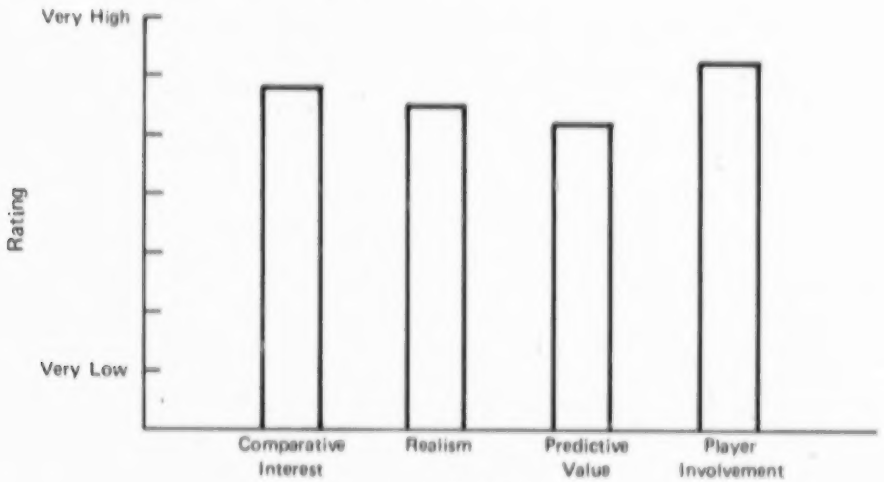
Questionnaire Item	Rating Factor	N	Mean	Standard Deviation
1	Comparative Interest (7-point scale)	81[a]	5.80	1.39
2	Realism of Problems and Procedures (8-point scale)	120	6.32	1.28
3	Predictive Value (8-point scale)	120	5.91	1.62
4	Player Involvement (6-point scale)	120	5.28	.73

[a]Players who had previously participated in at least one command post exercise.

On the Comparative Interest rating, the mean of 5.80 indicates that players found the FORGE simulation more interesting than command post exercises in which they had participated. The Realism mean of 6.32 shows that problems and procedures in the simulation were rated as "quite realistic." On Predictive Value, players judged it to be "quite likely" (mean = 5.91) that battalions which were effective in the simulation would also be effective in a real situation. Finally, the extent of Player Involvement was rated as "high" (mean = 5.28).

Figure 2 illustrates the players' evaluation of the simulation when item means were converted to a common seven-point scale. Comparative Interest, Realism, Predictive Value, and Player Involvement were all rated high. It can be concluded that the simulation generated interest and involvement on the part of players, was realistic, and was judged by players to elicit organizational performance similar to that which would occur in a real-life situation. It appears that face validity of the simulation was high.

Player Evaluation of the Simulation



Note: Item means converted to a common scale.

Figure 2

MANIPULATION OF PRESSURE

A major feature of the research design was manipulation of environmental pressure during the simulation. The purpose was to vary the degree of pressure upon the organizations in order to determine the effect of pressure upon Competence and Effectiveness. Procedures for manipulating pressure were discussed in the Method section and summarized in Table 1.

To obtain an estimate of the pressure the players experienced, each participant was asked to complete Questionnaire Items 5, 6, and 7 (see Appendix E). In Item 5 players were asked to rate, on a seven-point scale, the amount of pressure they felt during Phase II; Items 6 and 7 referred to Phases III and IV.

Table 5 summarizes players' reports of perceived pressure for the three phases. As a group, players reported "Moderate" pressure in Phase II, more than "Moderate" pressure for Phase III, and "Considerable" pressure for Phase IV. There was a steady increase in experienced pressure through the phases of the simulation.

An analysis of variance for phases and groups is summarized in Table 6. There were no differences in perceived pressure among the groups. On the other hand, there was a highly significant difference among phases, indicating that subjects experienced pressure differentially between the various phases. Since no interaction was found between groups and phases, it can be concluded that the noted differences between phases are not attributable to the members of particular groups but rather occurred within all groups.

The differences between all possible pairs of phase means were tested by the Newman-Keuls method. Each phase mean was significantly different from all others to at least the .05 level of confidence.

Table 5

Player Ratings of Experienced Pressure

Phase	Planned Pressure Condition	Rating	
		Mean	Standard Deviation
II	Low	4.00	1.12
III	Moderate	4.53	1.03
IV	High	4.79	1.25

Table 6

Analysis of Variance for Experienced Pressure

Source	*df*	*MS*	*F*	*p*
Between Subjects	119			
A (Groups)	9	3.26	1.32	NS[a]
Subjects within groups	110	2.47		
Within Subjects	240			
B (Phases)	2	19.47	28.10	<.01
AB	18	0.45	<1	NS[a]
B x Subjects within groups	220	.69		

[a]NS = not significant

It is concluded that players experienced different degrees of pressure for each phase, and that the pressure experienced was in accord with the experimental design. One slight discrepancy from the plan was the amount of pressure reported for Phase II; although it was planned as a "Low-Pressure" phase, players reported "Moderate" pressure for it. The result was a somewhat restricted range between the lowest and highest phases.

ACTIVITIES OF SIMULATED ORGANIZATIONS

Group activities in the simulation are summarized in Table 7. Data concerned with contacts indicate the level of activity within the groups. For the total simulate, the mean of approximately 1,377 contacts per group and the mean rate of 31 contacts per 15-minute period show that the simulation generated a high level of activity, which is typical for command and control personnel in combat operations of the type under consideration here.

The reductions in frequency and rate of contacts that occurred during Phase III, despite the increase in inputs, probably reflect the particular nature of probes for that

Table 7

Summary of Organizational Activities

Activity	Phase II		Phase III		Phase IV		Total Simulate	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Contacts (frequency)	467.2	36.3	354.3	39.9	555.8	39.3	1,377.3	91.8
Rate of Contacts[a]	51.9	4.0	39.4	4.4	61.8	4.4	51.0	4.4
Contacts per probe	9.2	0.7	11.4	1.3	12.1	0.9	10.8	0.7
Scoring units (frequency)	595.1	35.9	424.2	46.2	781.4	50.2	1,800.7	99.9
Scoring units per probe	11.7	0.7	13.7	1.5	17.0	1.1	14.1	0.8
Total contact minutes	306.4	38.4	248.2	26.4	374.0	31.5	928.6	81.0
Contact minutes per probe	6.01	0.75	8.01	0.85	8.13	0.69	7.25	0.63
Minutes per contact	0.66	0.06	0.70	0.05	0.67	0.04	0.68	0.05
Minutes per unit	0.52	0.06	0.59	0.04	0.48	0.03	0.53	0.06

[a]Rate = Number of contacts per 15-minute period.

phase. Phase II concluded with issuance of a Fragmentary Order for an air assault into a new Area of Operations. Accordingly, much of Phase III was consumed with planning, preparation, and movement of patrols to landing zones for extraction by helicopter. These activities did not require the minute-by-minute radio communication characteristic of more active phases of combat. Therefore, the total number of resulting contacts was reduced. On the other hand, the increases in contacts per probe and in contact time per probe from Phase II to Phase III reflect the increased complexity and importance of the problems for that phase.

Of particular significance for the analysis of competence scores, to be discussed in a later section, are the data concerned with scoring units. Mean scoring units per group was 1,800.7 and group mean units per probe was 14.1. It is apparent that each group produced a very large number of units for scoring, thus permitting a high level of confidence that scores developed from them are genuinely representative of the groups' performance.

GROUP PERFORMANCE

Frequencies of occurrence and scores for the major variables and sub-variables for the total simulate are summarized in Table 8. For all entries except Effectiveness, responses were free to vary, that is, no ceiling existed for the frequency with which any process could be performed. Therefore, frequency of process performance by a group reflected that group's unique propensity for performing processes and was not controlled by any design features other than number of inputs, which was constant for all groups. On the other hand, Effectiveness scores for the simulate were summations of scores on each of the 128 probes and, accordingly, frequency of Effectiveness Scores for every group was 128 with a maximum possible score of 6,400 (128 x 50).

Two aspects of the data are noteworthy. First, the groups did not perform Stabilizing and Feedback actions to any great extent. Reasons can only be conjectured, but detailed scrutiny of probe manuscripts suggests some possible explanations. With regard to Stabilizing, it appears that the groups simply did not perceive the necessity for performing such actions. Stabilizing involves those activities that are executed as

Table 8

Summary of Frequencies and Scores for Major Variables and Sub-Variables

Variable	Frequency		Score	
	Mean	SD	Mean	SD
Effectiveness	128.0	0.0	3,214.5	198.0
Competence	1,800.7	99.9	17,179.8	1,570.9
Competence Components:				
Reality Testing	1,013.4	70.0	9,889.8	908.9
Adaptability	783.9	55.9	7,222.5	741.2
Integration	3.4	5.9	67.5	107.2
Processes:				
Sensing	567.7	41.7	5,832.2	599.1
Communicating Information Sensed	443.6	45.6	4,029.6	395.5
Decision Making	261.2	20.6	2,909.0	380.3
Stabilizing	3.4	5.9	67.6	107.2
Communicating Implementation	288.6	39.4	2,174.2	236.8
Coping Actions	234.1	25.8	2,139.4	206.3
Feedback	1.1	1.5	28.0	39.9

supplemental to Coping Actions and are intended to counter possible instability within the organization resulting from Coping Actions. Thus, performance of a Stabilizing Action requires anticipation of potential negative effects at the time a decision is made to take a Coping Action. In turn, such anticipation requires individuals to maintain a perspective oriented toward the future welfare of the organization. Apparently this future-oriented perspective did not operate during the simulations reported here.

Two possible reasons for the lack of Stabilizing actions seem plausible. One possibility is that the players perceived the simulation as a temporary condition in which future-oriented activities were not essential. The second possibility is that, in the heat of combat operations, mission-oriented officers do not concern themselves with activities that are not directly related to the achievement of immediate objectives, even though such activities possess the potential for preserving future unit integrity and effectiveness. Such omissions would reflect extreme shortsightedness and a serious default in a critical leadership activity.

The paucity of Feedback scores appears to be due to the nature of the scoring system. By definition, Feedback was limited to those activities designed to obtain information about the outcomes of prior Coping Actions and to *planned organizational operations*, that is, the results of identified formal decisions rather than the spontaneous actions of individuals. Inspection of the probe manuscripts revealed that individual officers sometimes inquired about the outcomes of Coping Actions or took some spontaneous actions to evaluate outcomes. However, since designation of an activity as "Feedback" required definite linkage of it to a formal organizational decision to obtain information concerning outcomes, spontaneous individual actions were scored as "Active Sensing." It therefore appears that actions to evaluate outcomes did sometimes occur but

were not scored as "Feedback." Since few formal organizational decisions to obtain feedback occurred, the result was a minimum of Feedback scores for the various groups.

The second noteworthy aspect of the data summarized in Table 8 is the difference between frequencies for the various processes. Sensing was more than twice as frequent as Decision Making, which illustrates the fact that a single decision often stems from multiple sensing events. Communicating Information occurred less often than Sensing, reflecting the selectivity that often occurs in the transmission of information from those who have sensed it to those who must make decisions.

Communicating Implementation occurred more often than Decision Making. The difference between these two processes is somewhat misleading as an indicator of the number of linking communications required for implementation of decisions. By definition, Communicating Implementation was coded only when a linking, or relaying, communication was interposed between decision-maker and action-taker. A frequent example occurred when a battalion commander made a decision (Decision Making) and the implementing verbal order was relayed by an S3 (Communicating Implementation) to a company commander who executed the activity (Coping Action). Where a decision was made during the course of communication with the ultimate action-taker, or where the action-taker and decision-maker were the same, Communicating Implementation was not coded. The fact that, even under these conditions, more Communicating Implementation than Decision Making occurred suggests that many single decisions required numerous linking communications in order for them to be implemented.

Finally, the fact that Coping Actions occurred less often than Decision Making suggests the possibility of aborted or unimplemented decisions. This eventuality will be examined in a later section.

FREQUENCY AND EFFECTIVENESS

At the beginning of the study, it was conjectured that one possible determinant of organizational effectiveness might be frequency of process performance. Accordingly, a Pearson product-moment correlation between frequency of occurrence of all processes and Simulate Effectiveness scores was computed. The result was a correlation coefficient of .33, which is not significantly different from zero correlation (N = 10). Accordingly, it appears that Effectiveness is not related to the total number of processes which were performed. If Competence is related to Effectiveness, the source must lie elsewhere than in the frequency with which the organization performs its critical processes.

COMPETENCE AND EFFECTIVENESS

Intercorrelations between the scores of major variables and sub-variables are shown in Table 9. Of particular interest are the relationships of Competence and its components to Effectiveness.

For this study, the most important finding is the relationship between Competence and Effectiveness for the 10 groups studied. The correlation coefficient of .93 is highly significant ($p < .01$) and indicated a strong relationship between the two variables. Under the conditions of this study, Competence accounts for 86% of the variance in Effectiveness. Therefore, it is concluded that Competence is a principal determinant of Organizational Effectiveness.

Competence is the quality of process performance. The finding of a very high relationship between Competence and Effectiveness, together with the previously discussed finding of little relation between frequency of process performance and

Effectiveness, permits the conclusion that the principal contributor to Effectiveness is how well organizational processes are performed and not how often they occur.

The finding that Competence is a major determinant of Organizational Effectiveness confirms the principal hypothesis and accomplishes the fundamental objective of the research.

Table 9

Intercorrelations: Major Variables and Sub-Variables[a]

Variable	1	2	3	4	5
1 Effectiveness	--	.93**	.96**	.79**	.11
2 Competence		--	.94**	.92**	.33
3 Reality Testing			--	.73*	.10
4 Adaptability				--	.43
5 Integration					--

[a] **$p < .01$; *$p < .05$. Correlations are based upon eight degrees of freedom.

COMPONENTS OF COMPETENCE

The three components of Competence are Reality Testing, Adaptability, and Integration. Each component encompasses one or more organizational processes and each is conceived to be a critical aspect of an organization's ability to master its environment. Reality Testing is the capacity of the organization to search out, accurately perceive, and correctly interpret the properties and characteristics of its environments—in short, the information acquisition and information processing functions of the organization. This component includes three processes—Sensing, Communicating Information, and Feedback. Adaptability is the capacity of an organization to solve problems arising from changing environmental demands and to act effectively and flexibly in response to these changing demands. Adaptability includes three processes—Decision Making, Communicating Implementation, and Coping Actions. Integration is the maintenance of structure and the stabilization of function under stress and includes one process—Stabilizing.

Table 9 shows correlations with Effectiveness of .96 for Reality Testing, .79 for Adaptability, and .11 for Integration. Thus, both Reality Testing and Adaptability were significantly related to Effectiveness. On the other hand, correlation of Integration with all variables was not significant and, in fact, the relationships were quite small. This lack of relationship is explained, at least in part, by the relatively few occurrences of Stabilizing and the fact that this process was not performed at all by four groups. The result was a highly restrictive variance for Stabilizing, and thus for Integration, which, in turn, led to low correlations with other variables.

The high relationship between Reality Testing and Adaptability ($r = .73$) is to be expected. As described in the conceptual framework, the processes that comprise the Adaptive Coping Cycle are not independent. Rather, a chain exists in which the quality of each process depends, in part, upon the quality of preceding processes. For example, the quality of a decision will partly depend upon the quality of prior Sensing actions and, where communication occurs, will depend also upon the quality of Communicating Information. Thus, significant relationships would be expected between the various processes.

In the same way, the quality of Adaptability depends upon Reality Testing. To effectively adapt its operations to changing environmental conditions, an organization must first acquire the appropriate information, then interpret it correctly, and, finally, accurately communicate it to the proper decision-maker. If the processes of Reality Testing are performed well, the probability of effective performance of the Adaptability functions is enhanced; if Reality Testing is poor, effective performance of Adaptability will be less probable. Therefore, it was expected that a relationship would be found between Reality Testing and Adaptability.

A multiple correlation was computed between the Competence components and Effectiveness. For this correlation, R = .97. Beta weights for the components were .79 for Reality Testing, .25 for Adaptability, and -.08 for Integration. Because multiple correlation coefficients are unstable with small N's, the resulting coefficient of .97 is probably inflated. Therefore, a correction for bias was computed and a corrected coefficient of .94 was obtained. It should be noted that this corrected multiple correlation coefficient is quite close to the zero-order correlation between Competence and Effectiveness (r = .93).

Of special interest are the relative contributions of the various Competence components to Effectiveness; Reality Testing contributed about 76%, and Adaptability 20%. The contribution of Integration was negligible (-.008%). Other factors may have contributed, but it is apparent that both Reality Testing and Adaptability are critical determinants of military effectiveness. It is also apparent that, in the present study, Reality Testing contributed more than Adaptability, which demonstrates the importance of information acquisition and processing to the effectiveness of military organizations.

ORGANIZATIONAL PROCESSES

ANALYSIS OF RELATIONSHIPS

Organizational Processes are the fundamental elements of Competence. The processes are seven conceptually different, but not independent, functions that are performed by all organizations. Performance on each process contributed to the ultimate Competence score of each simulated battalion. Accordingly, knowledge of the relationships of each process to Effectiveness, Competence, and other processes has significant importance for understanding the dynamics of organizational performance.

Intercorrelations between Effectiveness, Competence, and the various Organizational Processes are shown in Table 10. For all processes except Stabilizing and Feedback, correlations with Effectiveness were significant beyond the .05 level of confidence. As discussed earlier in connection with Components of Competence, the fact that these two processes were not performed by some groups and occurred infrequently in the remaining ones resulted in highly restricted variances which, in turn, produced low correlations with Effectiveness. Obviously, in the FORGE simulation, Stabilizing and Feedback were not related to Effectiveness. However, because the lack of demonstrated relationship may have resulted from an anomaly in the simulated situation, it cannot be finally concluded that Stabilizing and Feedback do not possess validity as processes that are important to Effectiveness in the real world. The validity of these processes in relation to Effectiveness remains to be fully tested.

Sensing produced the highest correlation with Effectiveness (.92), Communicating Information was second highest (.83), with Decision Making, Communicating Implementation, and Coping Actions somewhat lower and approximately equal (.70, .71, and .72). Thus, those processes concerned with information acquisition and information processing

Table 10

Intercorrelations: Effectiveness, Competence, and Processes[a]

	Variable	1	2	3	4	5	6	7	8	9
1	Effectiveness	--	.93**	.92**	.83**	.70*	.11	.71*	.72*	.03
2	Competence		--	.95**	.72*	.86**	.33	.77**	.77**	.18
3	Sensing			--	.72*	.79**	.32	.58	.65*	.06
4	Communicating Information				--	.30	−.33	.58	.47	−.08
5	Decision Making					--	.63	.59	.67*	.37
6	Stabilizing						--	.14	.17	.49
7	Communicating Implementation							--	.68*	.29
8	Coping Actions								--	.18
9	Feedback									--

[a] **$p < .01$; *$p < .05$. Correlations are based on eight degrees of freedom.

showed the highest relationship to Effectiveness; those concerned with Adaptability were still strongly related, but in a somewhat lower degree.

The high intercorrelations between many of the processes illustrate the causal chain discussed earlier in connection with Components of Competence. The data in Table 10 again verify the interdependence of the processes that comprise the Adaptive Coping Cycle. In many instances, effectiveness on one process depends upon the quality of processes that precede it in the cycle. This demonstrates the necessity for good performance on all processes if full Competence and, hence, Effectiveness is to be achieved.

An interesting exception is the relation of all subsequent processes to Communicating Information. This process is highly correlated with Sensing ($r = .72$), as would be expected since communication should be dependent upon the quality of the information that is acquired. However, it is noteworthy that processes that follow Communicating Information in the cycle are not significantly correlated with it, even though some relationships are indicated. On the other hand, Communicating Information is highly correlated with Effectiveness ($r = .83$). It appears that this process may have contributed something unique to the variance in Effectiveness, something that was not related to any processes other than Sensing.

To explore these relationships further, a multiple correlation was computed, with the seven processes as independent variables and Effectiveness as the criterion. Neither the obtained R (.97) nor the corrected R (.86) was significant for the limited degrees of freedom (2) that were permissible. However, of more interest for the present discussion are the obtained Beta weights for the various processes, and the percentage that each process contributed to Effectiveness. Table 11 summarizes the results.

It is apparent that each of the five processes that produced significant zero-order correlations contributed to Effectiveness to an important degree. Once again the importance of Reality Testing (Sensing, Communicating, and Feedback) was confirmed. However, the most striking point for this discussion is that Communicating Information contributed 43.9% to Effectiveness, more than twice the contribution of the next highest process. This finding suggests the probability that Communicating Information made a unique contribution to Effectiveness, whereas the other four significant processes each

contributed a much smaller amount of unique variance, but also contained a common factor that influenced Effectiveness.

Table 11

Summary of Multiple Correlation Between Processes and Effectiveness[a]

Process	Beta	Percent Contribution
Sensing	.213	19.3
Communicating Information	.532	43.9
Decision Making	.195	14.0
Stabilizing	.114	1.2
Communicating Implementation	.074	5.0
Coping Actions	.156	11.5
Feedback	−.115	−.4

[a]The computed multiple correlation (R) is .97; the R corrected for shrinkage is .86. None of the relationships was significant.

LINKAGE AMONG PROCESSES

Further understanding of relationships among the processes is provided by Figures 3, 4, 5, and 6. For each of the five processes that correlated significantly with Effectiveness, group mean values for each probe were computed by summing all pertinent values within the probe and dividing by the number of occurrences. Thus, for every probe, there were available mean values representing performance on each of the five processes by each group.

All mean process values were then classified as "low" or "high." Values within the range of 10-25 were classified as "low" and those within the range of 26-40 were classed as "high." Probe Effectiveness scores were categorized in a similar manner. Classification of scores in this fashion made it possible to evaluate the effects of various high-low combinations of processes upon the performance of other processes and upon Effectiveness.

Figure 3 illustrates the effects of different combinations of Sensing and Communicating Information upon the quality of decisions. For example, for probes on which both Sensing and Communicating Information were high, decisions received high evaluations 60% of the time. In contrast, when both Sensing and Communicating Information were low, high-quality decisions occurred only 21% of the time. An even more dramatic result can be seen when Sensing was low and no communication occurred. High-quality decisions were made on only 9% of these probes.

Figure 3 also shows that high Sensing may be somewhat more important for good decisions than high Communicating Information. This is suggested by the finding that 40% of decisions were high when Sensing was high but Communicating Information was low. However, when communication was high but Sensing was low, 31% of the decisions were high.

Effects of Sensing and Communicating Information Upon Quality of Decisions

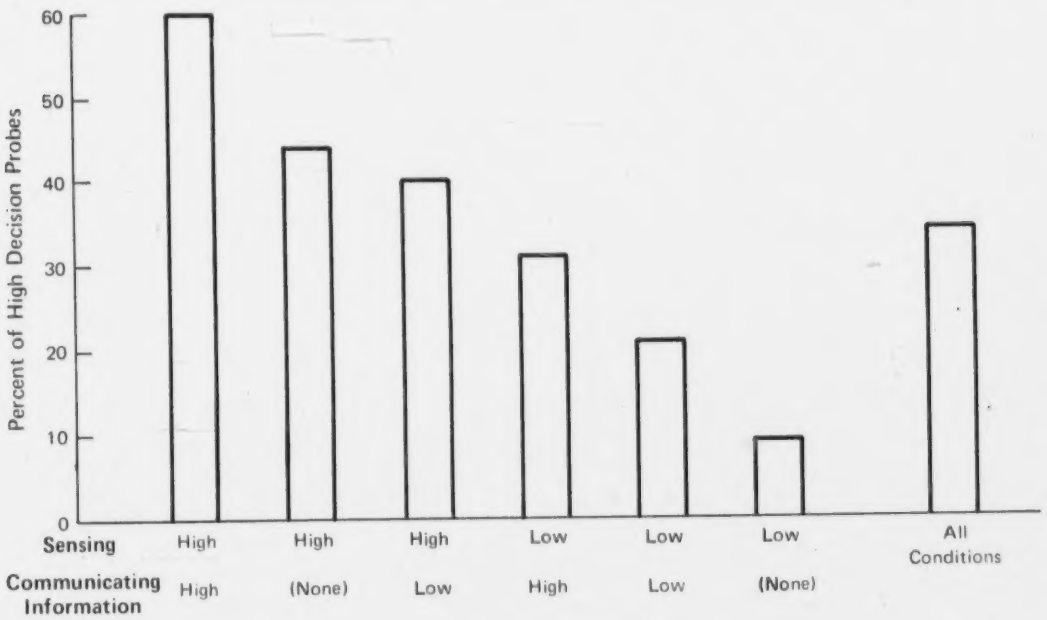


Figure 3

Effects of Sensing, Communicating Information, and Decision Making Upon Effectiveness

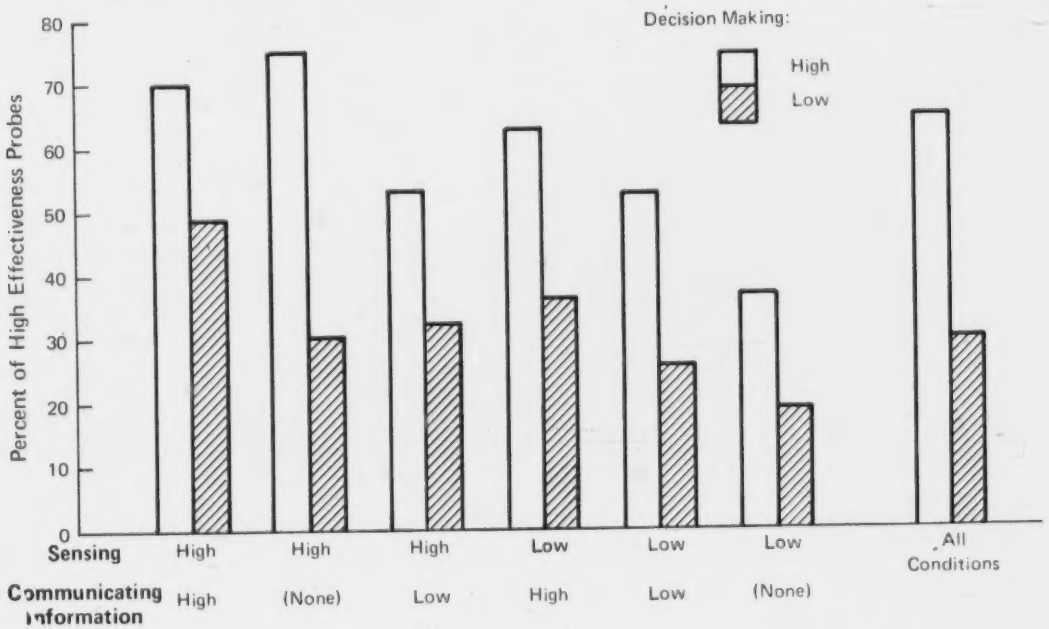


Figure 4

Effects of Decision Making and Communicating Implementation Upon Quality of Coping Actions

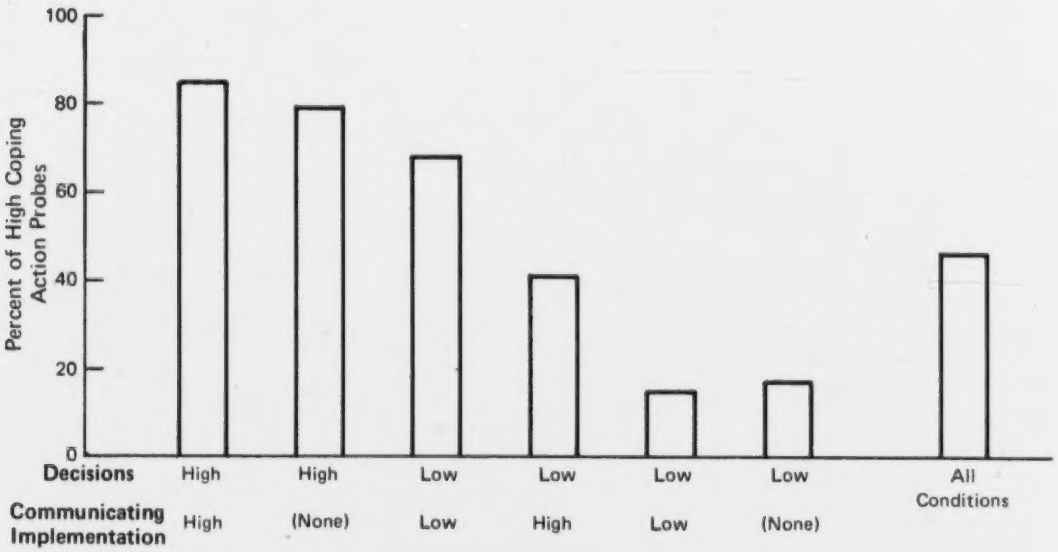


Figure 5

Effects of Decision Making, Communicating Implementation, and Coping Actions Upon Effectiveness

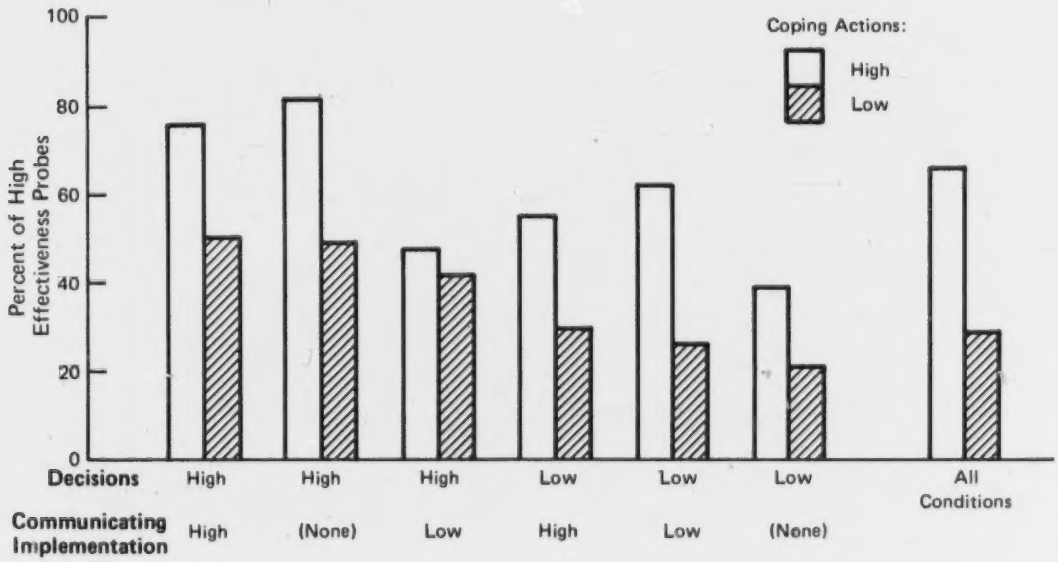


Figure 6

The dependence of decision making upon good information and communication is clearly demonstrated in Figure 3. However, these results do not suggest that decision making is solely a matter of good information being available to deciding individuals. The fact that high decisions occurred on only 60% of the probes where Sensing and Communicating Information were good indicates that something more is required—for example, good judgment or decision-making skills. The present data suggest, however, that high-quality Sensing and Communicating Information make effective decisions possible and that, without them, good decisions are impossible.

Figure 4 contrasts the relationships to Effectiveness of high- and low-quality decisions in combination with various conditions of Sensing and Communicating Information. For example, the figure shows that probes on which high Sensing, high Communicating Information, and high Decision Making occurred also received a high Effectiveness score 70% of the time. However, if Sensing and Communicating Information were high but the mean Decision Making score was low, Effectiveness was high only 48% of the time. When either Sensing or Communicating Information was low, a reduced number of probes received high Effectiveness scores, even when Decision Making was high. Furthermore, when all three processes were low, only a few probes were high in Effectiveness.

It may be conjectured that good decisions should have an equal probability of resulting in high Effectiveness regardless of the quality of processes that preceded them. However, decisions were evaluated "in view of the circumstances and available information." Accordingly, it was possible for a decision to be judged as good even though the information that was available to the decision-maker was poor. Figure 4 illustrates that a decision made with poor information will probably not be effective, despite the fact that it was "good" in view of the circumstances. Effectiveness requires equally good performance of three separate processes—Sensing, Communicating Information, and Decision Making.

Figure 5 shows the effects of Decision Making and Communicating Implementation upon the quality of Coping Actions. When both Decision Making and Communicating Implementation were high, the quality of Coping Actions was also high on 84% of the probes. On the other hand, when both Decision Making and Communicating Implementation were poor, only 15% of Coping Actions were high. The marked reduction in good Coping Actions when decisions were poor testifies to the critical importance of Decision Making to actions. Although poor Communicating Implementation resulted in some negative effects upon Coping Actions, it appears that Decision Making was the principal determinant of the quality of Coping Actions.

Figure 6 contrasts the influence upon Effectiveness of high and low Coping Actions with various combinations of Decision Making and Communicating Implementation. Again, when all three processes were high, 75% of the probes received high Effectiveness Scores. When the three processes were of poor quality, only 26% of the probes were highly effective.

The data presented in this section clearly show the relationship of process performance to organizational effectiveness. Furthermore, the data show the cyclical nature of the processes. The quality of each later process in the Adaptive Coping Cycle is, in part, dependent upon the quality of those processes that precede it. Therefore, it is apparent that the competence of an organization to cope with its environments depends upon effective performance of each process both separately and in combination.

EFFECTS OF PRESSURE

PRESSURE AND COMPETENCE

The research was designed to evaluate the effects of environmental pressure upon Competence. Division of the simulation scenario into phases and computation of Competence scores by phase permitted comparisons of each simulated organization's Competence under three different conditions of pressure (Low, Moderate, and High). It was hypothesized that, under pressure, the more competent organizations would be more effective and that organizations whose Competence deteriorated under pressure would be less effective, whereas those that maintained Competence under pressure would remain effective.

The number of probes introduced during the various phases differed (see Table 1). Since a Phase Competence Score is a summation of Probe Competence Scores and, accordingly, reflects the number of probes in the phase, comparisons between the phases in terms of Competence Scores are not meaningful. To equate phases for differences in numbers of probes, a mean Probe Competence Score $\left(\frac{\text{Phase Competence Score}}{\text{N Probes in Phase}}\right)$ for each phase was derived for each of the 10 groups. Comparisons between the phases were made on the basis of these mean Probe Competence Scores.

Competence Scores and Mean Probe Competence for the three conditions of pressure are summarized in Table 12. Mean Probe Competence is the "equated" score that permits comparison between pressure conditions. Table 12 shows that Competence was highest under the Low-Pressure condition. Under Moderate Pressure, Competence deteriorated an average of 16.7 points per probe. On the other hand, under High Pressure, Competence performance was 8.0 points better than under Moderate conditions but still 8.7 points less than for Low Pressure.

Table 12

Organizational Competence as Influenced by Environmental Pressure

Pressure Condition	Probes (N)	Competence Score		Mean Probe Competence	
		Mean (N=10)	SD	Mean (N=10)	SD
Low (Phase II)	51	7,209.7	788.2	141.4	15.5
Moderate (Phase III)	31	3,864.4	584.7	124.7	18.9
High (Phase IV)	46	6,105.6	713.1	132.7	15.5
Total Simulate	128	17,179.8	1,570.9	134.2	12.3

It appears that, when all groups are considered together, Competence degraded dramatically during Phase III (Moderate Pressure) but recovered somewhat during Phase IV (High Pressure). However, under High Pressure, the organizations were never able to regain the level of competence displayed under the more relaxed Low-Pressure condition.

The degradation in Competence that occurred in Phase III illustrates a phenomenon that is common in complex organizations. It will be recalled that the beginning of Phase III was marked by a radical change in mission and, hence, in operations. During Phase II,

the simulated battalion had been engaged in routine patrolling operations. However, at the beginning of Phase III, the battalion received a Fragmentary Order directing preparation and air assault into a new area of operations, where the unit was to establish blocking positions to deter a Viet Cong unit that was being driven by another task force. This assignment was a radical change from the routine activities to which TF 1-66 had become accustomed during the initial operational phase. This change, coupled with the increased pressure in Phase III, resulted in a deterioration in organizational processes.

The increase in Competence from Phase III to Phase IV suggests some recovery from the change discussed above. However, due to the strong pressure characteristic of Phase IV, recovery was not complete and Competence remained less than the base line established in the Low-Pressure condition.

The data in Table 12 show that Organizational Competence is affected both by change in environmental conditions and by pressure from the environment. Thus, it is apparent that Competence is an important aspect of an organization's ability to flexibly and rapidly adapt to changes in its environments.

DIFFERENTIAL EFFECTS

To determine whether pressure affected Competence of some groups differently than others and whether such differential effects influenced Effectiveness, Competence scores of the five most effective groups and the five least effective groups were compared. The five battalions that achieved the highest scores in Effectiveness for the total simulate were identified and placed in a "High Effectiveness" group. The five battalions that received the lowest Effectiveness scores were placed in a "Low Effectiveness' group. Mean Probe Competence Scores of the two classifications were then compared for each phase.

Competence

Table 13 shows Competence performance by phases, and Table 14 summarizes a groups-by-phases Analysis of Variance. Figure 7 illustrates graphically the differential effects of pressure upon the two classes of groups.

Competence of the High Effectiveness groups was significantly better than for groups with Low Effectiveness under all pressure conditions. Significant differences occurred between phases for both classes.

Table 13

Competence Performance of High Effectiveness and Low Effectiveness Groups Under Differing Degrees of Environmental Pressure[a]

	High Effectiveness Groups		Low Effectiveness Groups	
Pressure Condition	Mean (N=5)	SD	Mean (N=5)	SD
Low (Phase II)	146.5	15.0	136.2	12.3
Moderate (Phase III)	135.2	12.8	114.1	16.0
High (Phase IV)	143.4	12.5	122.0	6.7

[a]Scores are mean Probe Competence Scores for each phase.

Interaction between groups and phases was not significant, indicating no difference in the direction of the effects of pressure upon the two types of groups. For both High and Low Effectiveness groups, Competence in Phase III deteriorated from that in Phase II and, for both groups, some recovery occurred in Phase IV. These similarities in the direction of pressure effects account for the finding of no interaction between groups and phases.

Table 14

Analysis of Variance for Phase Competence of High and Low Effectiveness Groups

Source	*df*	*MS*	*F*	*p*
Between Groups				
A (High and Low Groups)	1	2,312.65	8.83	<.05
Groups within classes	8	261.94		
Within Groups	20			
B (Phases)	2	697.04	3.85	<.05
AB	2	101.13	<1	NS[a]
B x groups within classes	16	181.26		

[a] NS = Not Significant

However, of special significance for understanding the relationships between pressure, Competence, and Effectiveness are (a) differences in the gradients of Competence degradation between Phases II and III, and (b) differences in the amount of recovery in Phase IV. These differences are clearly shown in Figure 7. Competence deteriorated for both groups during Phase III. However, for the High Effectiveness groups, the degradation in Competence amounted to an average of 11.3 points per probe, whereas scores for Low Effectiveness groups decreased by 22.1 points. Obviously, the change in mission and operations and the increase in pressure that occurred in Phase III affected the Competence of the Low groups much more than that of the High groups.

High Effectiveness groups recovered Competence in Phase IV to within about three points of their original Phase II level, despite the extremely intensive High-Pressure condition. On the other hand, Low Effectiveness groups never made much of a recovery. A modest increase in the Competence of these groups can be seen for Phase IV; however, it is not sufficient to be construed as a recovery. Under high pressure, these groups continued to function at a greatly reduced level of Competence and never approached their original performance.

Three aspects appear to account for the poorer military performance of the Low Effectiveness groups. First, they performed at a level of Competence that was consistently lower throughout all phases than that of the High groups. Second, when faced with a change in mission and operations, Competence deteriorated much more for the Low groups. Finally, after deterioration in Competence occurred, Low groups could not recover under increased pressure and, therefore, continued to function at a greatly reduced level.

These findings provide an understanding of the influence of Competence upon Effectiveness and the maintenance of Effectiveness under environmental change and

Mean Probe Competence Scores for High and Low Effectiveness Groups Under Environmental Pressure

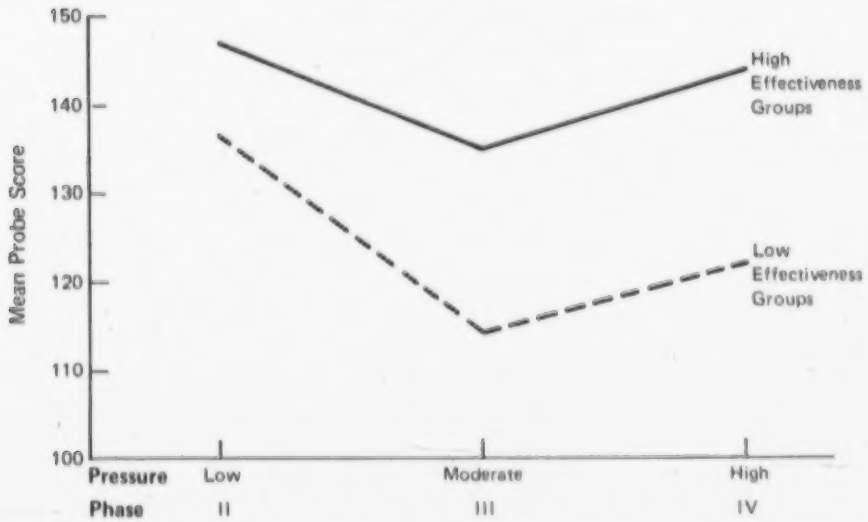


Figure 7

pressure. When an organization maintains Competence at a sufficiently high level under pressure or when changes occur within its environments, it is likely to continue to perform effectively. If Competence deteriorates under pressure or in the face of change, Effectiveness will also be reduced.

The capacity of an organization to adapt to rapid and drastic changes or increased pressure in its environments depends, in large part, upon its ability to adequately perform the organizational processes that comprise Competence. The quality of process performance is a major determinant of the adaptability of organizations.

Competence Components

In Table 15, mean Probe Competence Component Scores are summarized by phase for High Effectiveness and Low Effectiveness groups. Figure 8 illustrates graphically the differential effects of pressure for Reality Testing and Adaptability. As discussed previously, Integration was performed so infrequently as to result in a meaningless score, so Integration is not included in Figure 8.

Pressure affected Reality Testing and Adaptability differently. While Reality Testing deteriorated in Phase III for both High and Low Effectiveness groups, marked recovery in Phase IV is also apparent for both types of groups. The group patterns are similar, the only real difference being the consistently better performance by High Effectiveness groups throughout all phases.

On the other hand, group patterns for Adaptability are quite different. For High Effectiveness groups, Adaptability remained essentially the same under all conditions, with only a 4.0 point degradation under high pressure. In constrast, Adaptability for Low groups deteriorated during Phase III and continued to fall during Phase IV, although with a somewhat reduced gradient.

Table 15

Competence Component Performance of High Effectiveness and Low Effectiveness Groups Under Differing Degrees of Environmental Pressure[a]

Competence Component	Pressure Condition	High Effectiveness Groups		Low Effectiveness Groups	
		Mean (N=5)	SD	Mean (N=5)	SD
Reality Testing	Low	84.3	6.3	76.1	6.6
	Moderate	74.2	5.2	63.1	7.5
	High	86.0	9.3	73.7	4.8
Adaptability	Low	61.3	9.1	59.8	5.9
	Moderate	59.8	9.3	50.7	7.8
	High	57.3	3.5	48.0	3.9
Integration	Low	1.0	1.4	.4	.5
	Moderate	1.1	1.4	.3	.6
	High	.1	.2	.4	.5

[a]Scores are mean Probe Competence Component Scores for each phase.

Mean Probe Scores for Two Competence Components for High and Low Effectiveness Groups

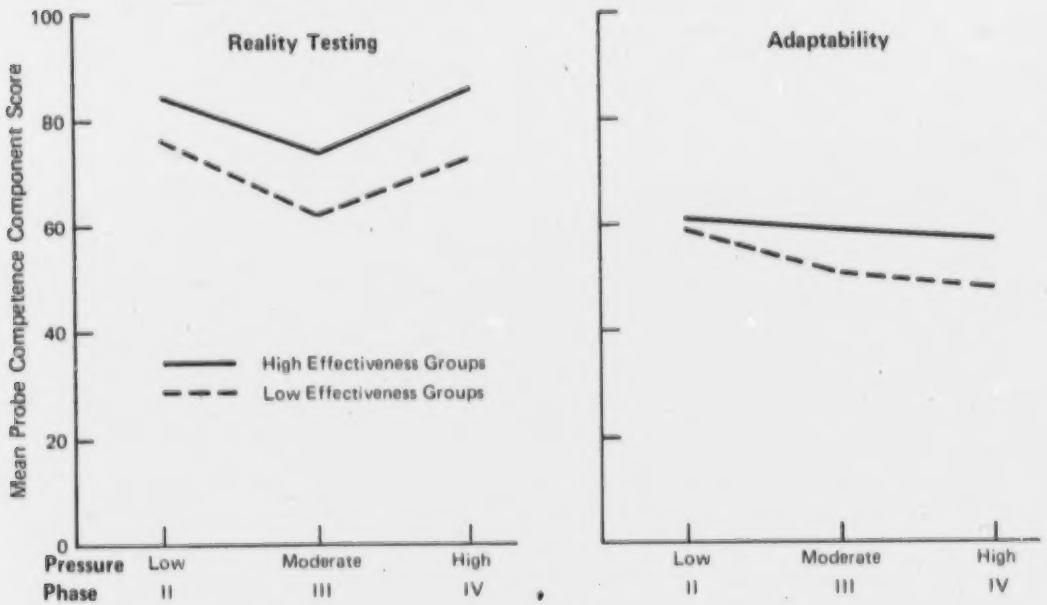


Figure 8

These data provide additional understanding of the effects of pressure upon organizational performance. High Effectiveness groups were significantly affected in Reality Testing by the sudden change in mission and operations encountered at the beginning of Phase III. However, despite this change, High Effectiveness groups maintained the level of their Adaptability functions and, since they also recovered in Reality Testing during Phase IV, emerged with reasonably effective results. In contrast, despite recovery of Reality Testing, Adaptability functions of Low groups did not hold up under change or pressure, and the result was reduced effectiveness. It is clear that Low groups performed less effectively because of (a) consistently lower performance of Reality Testing and (b) breakdown in Adaptability functions under increased environmental pressure.

Processes

Table 16 summarizes mean Probe Process Scores by phase for High and Low Effectiveness groups and Figure 9 illustrates the differential effects of pressure upon the five significant organizational processes for the two types of groups. Both types of groups manifested the same trends across phases for Sensing and Communicating Information. These processes deteriorated as a result of the changes in mission and operations which were introduced in Phase III, but recovered under the high pressure of Phase IV. The principal difference between the groups was consistently poorer performance by the Low Effectiveness groups throughout all phases. Scores for Low Effectiveness groups were lower in 13 of 15 comparisons of scores for the five processes which correlated significantly with Effectiveness. (It should be noted that the data presented in Table 16 and illustrated in Figure 9 are based upon means (N=5) of mean Probe Process Scores and, accordingly, the mean total-score differences between phases can be quite large.)

Greatest differentials in performance under pressure occurred in Decision Making, Communicating Information, and Coping Actions. Whereas High groups deteriorated somewhat in Decision Making during Phase III, they recovered in Phase IV. On the other hand, after reduction in quality of Decision Making, Low groups maintained this reduced level in Phase IV.

For both High and Low groups, Communicating Implementation showed the most effects of pressure. In both groups, performance on this process consistently deteriorated as pressure increased. However, rate of deterioration was greater for Low Effectiveness groups during Phase III, and the downward trend continued in Phase IV.

Communicating Implementation is concerned with the relaying of messages by a third party between the original decision-maker and the individual who must execute the decision. For example, an Operations Officer might relay to a Company Commander an order reflecting a decision made by a Battalion Commander. The data show that, as pressure increased, the quality of these relayed communications deteriorated. This effect is important because individuals who execute organizational actions must receive accurate and complete instructions if they are to effectively implement the decisions made by others. If decisions and their implementing directives become distorted under the stress of environmental pressure, individuals responsible for implementation can never correctly carry out the intent of decision-makers.

It is noteworthy that High Effectiveness groups improved the quality of Coping Actions under increased pressure, whereas these actions deteriorated for Low groups. The improvement occurred despite the previously noted deterioration in Communicating Implementation. This apparent paradox is explained by the fact that, under increased pressure, company commanders in the High Effectiveness groups made more decisions and took more actions on their own initiative without referring problems to the battalion headquarters, thereby reducing the possibility of distortion and errors in communication. Apparently, the result was better actions. On the other hand, company commanders in

Table 16

Process Performance of High and Low Effectiveness Groups Under Differing Degrees of Environmental Pressure[a]

Organizational Process	Pressure Condition	High Effectiveness Groups		Low Effectiveness Groups	
		Mean (N=5)	SD	Mean (N=5)	SD
Sensing	Low	49.6	4.7	44.5	4.3
	Moderate	44.6	4.0	36.2	3.0
	High	51.8	4.1	43.0	3.0
Communicating Information	Low	34.2	3.6	31.6	2.6
	Moderate	29.5	3.7	26.5	4.9
	High	34.1	5.4	30.5	2.9
Decision Making	Low	25.5	5.9	22.3	2.4
	Moderate	23.3	3.1	19.7	2.9
	High	24.5	1.6	20.0	1.8
Stabilizing	Low	1.0	1.4	.4	.5
	Moderate	1.1	1.4	.3	.6
	High	.1	.2	.4	.5
Communicating Implementation	Low	19.8	3.0	20.6	2.4
	Moderate	18.0	3.4	14.3	3.3
	High	15.1	1.7	13.0	1.9
Coping Actions	Low	16.0	1.2	16.9	2.1
	Moderate	18.5	3.7	16.8	4.1
	High	17.7	1.1	15.0	1.2
Feedback	Low	.5	.6	.0	.0
	Moderate	.2	.4	.4	.5
	High	.3	.4	.2	.3

[a]Scores are mean Probe Process Scores for each phase.

Low groups more often continued to refer decisions to higher levels and, accordingly, placed a greater load upon both communication channels and higher-level personnel. This may have resulted in both delayed and incorrect actions.

Aborted Decisions

In complex organizations, where many decisions are made at high levels but implemented at lower ones, numerous opportunities exist for breakdowns to occur between the point of decision and the point of intended execution. When a breakdown in organizational communication processes occurs, a decision may never be implemented as intended. Such aborted decisions can have serious consequences for effectiveness.

In FORGE, "aborted decisions" were defined as those completed decisions that were communicated to someone for action but upon which no action was taken. The coding system provided for keying each action to its originating decision by recording the unit number of the decision in Column Q, "DOCI Follow Up," of the Score Sheet. This procedure permitted computer identification of all decisions for which actions

Mean Probe Scores for Five Organizational Processes for High and Low Effectiveness Groups

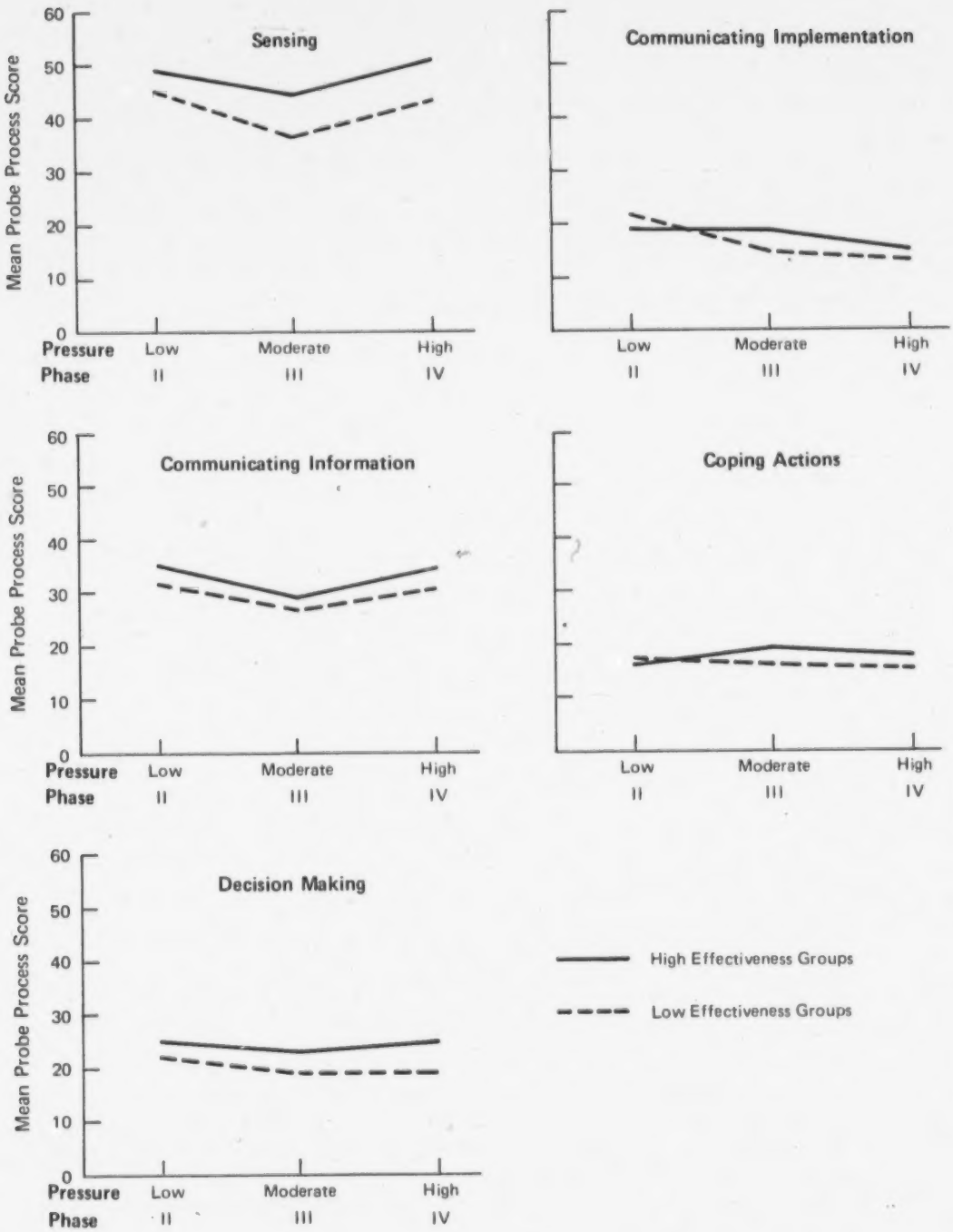


Figure 9

occurred and all decisions for which no actions could be traced. "Aborted decisions" were those for which no implementing actions could be traced.

Figure 10 shows the effects of pressure upon the abortion of decisions by the five High Effectiveness and the five Low Effectiveness groups. It is clear that, throughout the simulate, the Low groups aborted more decisions. However, of special significance is the large increase in decisions aborted by the less effective groups under the high pressure conditions of Phase IV. Whereas mean aborted decisions in Phase III were 2.8 and 4.2 for the High and Low Effectiveness groups respectively, High groups had 3.2 incomplete decisions in Phase IV, an increase of only .4, but, Low groups aborted an average of 11.8 decisions, an increase of 7.6 per group.

It is apparent that, under the stress of high environmental pressure, processes for implementing decisions frequently broke down in the Low Effectiveness groups. Implementation processes functioned much more reliably in the High Effectiveness groups.

Aborted Decisions of High Effectiveness and Low Effectiveness Groups

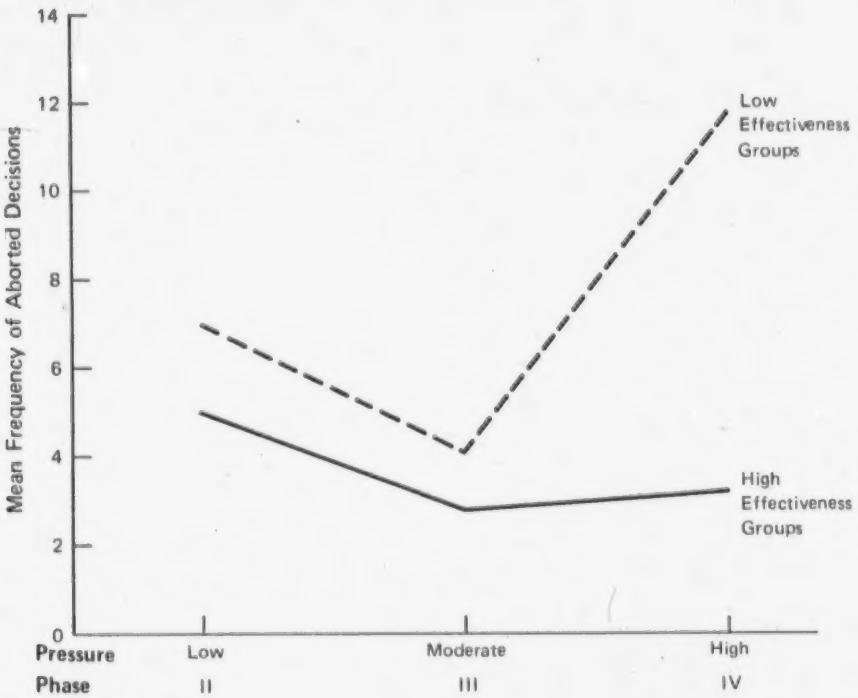


Figure 10

The findings indicate a probable major cause of reduced effectiveness in organizations. Even though decisions may be of the best, when an organization cannot maintain all of its other adapting processes (Communicating Implementation, Coping Actions) under pressure, problems for which solutions have been presented may never be overcome. In short, at least adequate performance of all processes is necessary in order for effectiveness to be achieved.

What extrapolations might follow from the information presented in this section? The data provide considerable understanding of reasons why the effectiveness of many organizations is reduced when radical changes occur in their environments and when

environmental pressures increase. For some organizations, a major effect of change and pressure is a deterioration in the performance of critical organizational processes, which, in turn, results in reduced effectiveness in mastering operational problems. Although all processes are affected by change and pressure, those processes concerned with Adaptability (Decision Making, Communicating Implementation, and Coping Actions) seem to be more susceptible to deterioration and the effects are more lasting.

Not all organizations are equally susceptible to change and pressure. For some, process deterioration is minor and temporary, and recovery is rapid. For others, deterioration continues with pressure and reduced effectiveness persists.

LOCUS OF PROCESS PERFORMANCE

The point within the organization at which various processes are performed is important both in organizational analysis and in training. Table 17 summarizes the frequency with which each process was performed by the different positions within the simulated battalions.

Table 17

Frequency of Process Performance by Position[a]

Position	Sensing		Communicating Information		Decision Making		Stabilizing		Communicating Implementation		Coping Actions		Feedback	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bn Co	17.6	3.6	26.4	6.8	25.1	4.8	.1	.3	26.2	9.3	2.4	2.1	.0	.0
Bn Exec Officer	3.9	2.4	14.7	7.1	13.3	8.5	.1	.3	28.1	13.6	2.9	2.8	.0	.0
S1	15.9	3.7	20.2	8.6	9.6	3.9	.0	.0	30.3	13.3	7.7	3.2	.0	.0
S2	22.2	3.7	36.5	12.9	8.2	3.7	.1	.3	13.0	5.9	3.4	2.5	.0	.0
S3[b]	46.7	10.2	69.9	11.8	35.6	8.2	.2	.4	56.4	10.2	15.3	6.1	.2	.6
S4	18.6	3.7	26.8	9.0	19.8	8.2	.0	.0	31.9	6.1	14.4	7.0	.0	.0
Co, Hq &Cbt Sup Co	66.3	13.6	43.8	12.4	16.3	6.6	.8	1.2	19.7	8.3	33.3	8.2	.1	.3
Co, Mvr Co[c]	93.2	15.4	47.9	10.7	32.8	9.1	.5	1.2	17.2	6.0	36.3	10.1	.1	.3

[a]N = 10 except for Commander, Maneuver Company.

[b]Includes Assistant S3.

[c]Mean and standard deviation for commanders of all maneuver companies (N = 40).

Sensing was performed predominantly by company commanders, with maneuver companies producing by far the greatest number of sensing activities. With one headquarters company and four maneuver companies in each battalion, commanders of the companies participated in an average of 439.1 sensing events per battalion. This result clearly demonstrates the heavy responsibility of lower-level battalion personnel for the valid acquisition of essential information. Although company commanders were the lowest level of player personnel in the simulations, responsibility for sensing activities in "real world" units frequently falls upon lower-level personnel in platoons, squads, and fire teams. These results indicate the critical importance of specifically training personnel at lower levels to effectively perform sensing and communicating functions.

Within the battalion headquarters, Sensing was performed most often by the Operations Officer (S3). When considered solely in terms of numbers of Sensing activities, this result is somewhat surprising, because responsibility for obtaining information about the external environment is centered mainly upon the Intelligence Officer (S2). However, a survey of Sensing occurrences in the probe manuscripts provided an explanation. Sensing of the immediate tactical environment is performed principally at company levels and, although the S2 is responsible for coordinating these activities and compiling results for interpretation, he does not actually perform the direct Sensing activities. Sensing for both the S2 and the S3 consisted of the acquisition of information from brigade levels—a most important aspect of a battalion's total environment. The S2 received certain intelligence data from Brigade. However, since more of the communications from Brigade deal with operations (directives, guidance, commander's desires, etc.), the Operations section performed the predominant Sensing function within the battalion headquarters.

Communicating Information was performed to a much greater extent by the S3 than by any other position in the battalion. This finding is testimony to the critical role played by the Operations Officer in coordinating and disseminating information. It also reflects the role of the S3 in discussing and interpreting the action implications of information with lower-level personnel who have sensed it. This coordinating and disseminating function is further illustrated by the larger number of S3 communicating activities in comparison with Sensing. Often, the S3 must disseminate an item of information to several recipients (e.g., battalion commander, Brigade, and five different company commanders) and this results in multiple communications concerning a single item.

On the other hand, company commanders communicated much less than they sensed. This finding has crucial importance, because it suggests that company commanders did not pass on to higher levels much of the information that they received concerning the tactical environment. Whether to inform higher levels concerning information, often fragmentary, about a local situation is always a difficult decision, and frequently requires astute judgment. However, when it is recognized that maneuver company commanders communicated information upward only one-half as often as they received it from lower levels, it can be questioned whether battalion headquarters received sufficient information to make timely and accurate decisions concerning operations.

Examination of phase data (not shown) indicates that occurrences of Sensing and Communicating Information were approximately equal for company commanders during Phases II and III, but that the ratio of the two processes was more than two to one in favor of Sensing during Phase IV. In short, during the high-intensity combat of Phase IV, company commanders were directing their units rather than passing on information. This appears to be characteristic of combat situations and may be necessary. However, it again points up the potential for a serious problem in battalion operations. If battalion headquarters are not sufficiently informed because individuals who possess information must, of necessity, give priority to the direction of their units, inadequate operational decisions may result. The results also point up the very difficult dual role of the company commander as both operations director and information processor.

Data concerning Decision Making were as expected. Although some decisions were made by all personnel, they were most heavily centered in the battalion commander, S3, and company commanders. The fact that S3s made more decisions than battalion commanders and about the same as company commanders illustrates the critical role of the Operations Officer in an infantry battalion.

As noted earlier, Stabilizing was not performed very often by any group. However, with the limited data available, it is interesting to note that this process was performed much more often by company commanders than by battalion commanders. Feedback actions were not performed often enough to provide any discernible pattern for interpretation.

Staff officers performed Communicating Implementation functions most often. Performance of this relaying function by staff officers was to be expected. However, the number of these activities performed by battalion commanders is somewhat more than anticipated. Examination of probe manuscripts showed that Communicating Implementation by battalion commanders consisted mainly of passing on brigade guidance without modification or additional decisions. The large number of relaying communications performed by S3s consisted of (a) communicating decisions of battalion commanders to company commanders and (b) further relaying of brigade guidance.

As predicted by the conceptual framework, Coping Actions were performed predominantly by company commanders. These individuals operated at the boundaries of the simulated organization and executed actions designed to overcome the tactical environment. Coping Actions that were performed by battalion headquarters personnel consisted of (a) actions against the internal environment (S1 and S4) and (b) responses to inputs from Brigade (Battalion Commander, S2, and S3).

Overall, the data in Table 17 indicate a pattern for process performance in military tactical organizations that confirms the conceptual framework for FORGE. It is concluded that the Adaptive Coping Cycle is a viable concept for analyzing the loci of process activity, and quality of process performance is a valid indicator of dysfunctional positions within organizations.

Chapter 6

DISCUSSION AND IMPLICATIONS

Competence is the ability of an organization to continually and accurately sense the properties of both its external and internal environments, to internally process the information that is sensed, and to flexibly adapt its operations to cope with its constantly changing environments in accordance with its goals or missions. The capacity of an organization to identify, solve, and adapt to environmental problems derives in part from the formal body of policies and procedures intended to guide decisions and actions, in part from the adequacy of techniques and equipment, and in part from the skills of individual personnel in performing the necessary activities. However, a remaining critical element involves the performance of organizational processes that convert policies, procedures, techniques, and skills into viable organizational responses. The purpose of this research was to establish the relationship of Competence to Organizational Effectiveness and to determine the relative contributions to Effectiveness of processes of which Competence is comprised.

DISCUSSION

THE DETERMINANTS OF EFFECTIVENESS

The results of the research are clear. The finding of a strong relationship between Organizational Competence and Organizational Effectiveness shows that Competence is a principal determinant of Effectiveness. The Effectiveness scores used in this study were measures of the extent to which the simulated battalions solved and mastered military problems presented by a complex combat environment and, thus, the extent to which the units accomplished their missions. The results show that the Competence displayed by command and control personnel *as a team* plays a most potent role in the outcomes of military operations. All other factors being equal, units with high Organizational Competence are more likely to be effective in mission accomplishment. If Competence of a unit is low, it will probably be ineffective or, certainly, much less effective than organizations with higher Competence.

Variability in other factors—such as training and experience of unit personnel, quality and quantity of equipment and firepower, and numbers and quality of enemy forces—can offset, to some degree, the effects of Organizational Competence. For example, even if Competence is high, poor quality of personnel, equipment, and firepower or overwhelming numbers of enemy forces may reduce effectiveness. However, it would appear that high Competence in a unit should minimize the detrimental effects of intervening negative factors. Also, it seems clear that at least minimal Competence is necessary for effectiveness, regardless of the high quality of personnel or equipment. Because of the critical nature of the processes that comprise Competence, it is apparent that an otherwise outstanding organization would be less than effective if the Competence performance of its command and control personnel was poor.

Conceptually, the Competence of an organization is displayed in its performance of seven critical processes, each of which is conceived to be an essential contributor to its

effectiveness. The results verify the relationship of five of these processes to Effectiveness. They are Sensing, Communicating Information, Decision Making, Communicating Implementation, and Coping Actions. Significant relationships were not found for Stabilizing and Feedback, possibly because these processes were not performed often and not by all groups. Further study is required to determine whether these processes influence the accomplishments of other organizations.

The seven organizational processes logically fall into three functional groups or components. Two components, Reality Testing and Adaptability, contributed strongly to Effectiveness. The third component, Integration, consists solely of the Stabilizing process and, for the reasons discussed earlier, its relationship to Effectiveness could not be reliably tested.

Although both Reality Testing and Adaptability were found to be highly significant determinants of Effectiveness, an especially noteworthy result is the higher contribution made by Reality Testing. This component consists of those processes concerned with the acquisition and processing of information, and is the means whereby an organization obtains accurate understanding of its environments and the demands they place upon the organization. The results demonstrate the critical importance of Reality Testing both for Adaptability and, ultimately, for Effectiveness. They suggest the urgent need for organizations to emphasize information-acquisition and information-processing activities to the same extent as they emphasize the Adaptability processes of Decision Making, Communicating Implementation, and Coping Actions.

The importance of information acquisition and information processing is further confirmed by the results concerned with interrelationships between the processes. These results show that the various processes are not independent, although each possesses some aspects that contribute uniquely to Effectiveness. Furthermore, since a sequential relationship is involved, it is apparent that processes that occur late in the Adaptive Coping Cycle are dependent upon the quality of those that occur earlier. Thus, the quality of Decision Making is, in large part, dependent upon the information that is available and communicated (Sensing and Communicating Information). In the same way, the quality of actions that are taken to cope with the environment depend upon the decisions from which they derive and the quality with which instructions to implement them are communicated. All of these findings demonstrate that both Reality Testing and Adaptability are essential to Effectiveness and must receive equal attention in both training and execution.

The results concerned with the effects of change and pressure demonstrate the importance of Organizational Competence to the ability of organizations to adapt to rapidly changing conditions in their environments and to cope with intensive environmental pressures. The results show that the quality of organizational processes is affected by both change and pressure. Organizations that maintain the quality of Competence when faced with change and pressure are more effective, and when Competence deteriorates, organizations lose their effectiveness.

Maintenance of Competence in the face of change involves the ability of the organization to rapidly and correctly identify modified aspects of its environments, attach the correct meaning to the changes, correctly decide upon necessary modifications in its operations, and execute them in accordance with the decisions and the available knowledge about the environments. In short, the organization continually evaluates the reality of its total situation and adapts its activities to the specific demands of that situation. When the quality of process performance is high, information is current and accurate, decisions are made promptly and with full consideration of all information, and actions are executed as intended and in full coordination. Under these conditions, the organization is alert for all contingencies and flexible in adapting to them.

Maintenance of Competence under pressure involves the ability of an organization to continue adequate performance of its critical processes under the stress imposed by increased frequency, variety, and complexity of environmental demands. The results show that some organizations are better able to maintain Competence under pressure than others and, hence, are more effective. At present, the reasons why organizations differ in their ability to maintain Competence are not known. It is suspected, however, that this ability can be affected by certain social-psychological characteristics of the command and control team. This question is being examined in FORGE II.

Data concerned with the organizational foci of process performance show that the types of processes that are performed may differ according to level and position. In general, Sensing and Coping Actions occur most frequently at points that are most in contact with the environments. If these are external environments, the points are always at the boundaries of the organization, but the location of the points may differ according to the type of organization. For example, in military tactical units, sensing of much of the external environment and most actions intended to cope with it are performed by individuals at low organizational levels, since they are most directly in contact with the tactical environment. On the other hand, in a nontactical unit, low-level personnel may not sense or execute actions at all because the principal external environment of that unit may be other organizations whose representatives must, of necessity, be contacted only by higher-level personnel.

With regard to internal environments, sensing and actions may be performed by occupants of any position, but, even here, the most accurate sensing and the most critical actions will occur at those points that are in contact with most of the organization's members—for example, at first-line leadership or supervisory positions.

Decision Making may occur at any level in an organization and usually does. However, because of the nature of their particular responsibilities, occupants of some positions may make more decisions than others. Line or command positions, for example, may make more decisions than staff positions. Furthermore, the numbers of decisions that are required may be greater at lower levels than at higher ones, as demonstrated in the present study, where company commanders made many more decisions than personnel in battalion headquarters. On the other hand, decisions that are made at higher levels are usually more complex and more widely applicable than those made at lower levels.

Finally, Communicating Information is performed most often by individuals who have sensed changes in the environments—usually these are personnel at the boundaries of the organization. On the other hand, while Communicating Implementation may occur anywhere, it is performed most often by individuals intermediate between decision-makers and implementers and, therefore, occurs most frequently within internal organizational channels.

THE NATURE OF COMPETENCE

The results confirm the validity of the conceptual framework as a viable approach for analyzing and understanding the performance of complex organizations. The approach conceives an organization to be a network of relationships between members, an open system that is in constant interaction with a variety of environments, some of which may be more dominant than others but whose relative dominance may shift over time or with type of organization. In this conceptualization, Effectiveness is the extent to which an organization accomplishes its goals or missions. Operationally, Effectiveness is the adequacy with which an organization copes with problems presented by its environments, to include goals or missions assigned by higher levels—a most significant aspect of the environment.

This emphasis upon organizational responses to problem situations points up the role of the organization as a problem-solving, decision-making, action-taking system in which the basic purpose is to take direct, unified action in an environment that presents a continuous flow of uncertainty situations. In such a system, the means whereby information, decisions, and actions are brought into conjunction involve a complex interplay between positions and between levels. This constant interplay is the source of Organizational Competence and, accordingly, is a principal determinant of Effectiveness.

The processes that comprise Competence subsume most of the activities performed by "command and control" personnel in any organization. Stated in general terms, the processes are:

(1) Sensing—the acquiring of information concerning the environments, both external and internal, which are significant for the effective accomplishment of objectives. The specific nature of Sensing activities that are required may differ according to the type and mission of the organization and the character of the environments that are significant to it. Whatever their specific nature, all Sensing activities involve seeking, acquiring, and interpreting information. The results of this study show that high-quality Sensing is essential for adequate performance of the remaining processes.

(2) Communicating Information—those activities whereby information concerning an organization's environments is made available to those individuals who should act upon it. This process involves the initial transmittal of information by those who have sensed it and the dissemination of the information throughout the organization. Most important, the process also includes "discussion and interpretation," those communicative acts through which clarification is attempted or implications of the information are discussed. The results indicate that this process makes a unique and significant contribution to organizational effectiveness.

(3) Decision-Making—those activities leading to the conclusion that some action should be taken by the organization. This process is limited to the deliberative acts of one or more persons and is usually evidenced by the initial communication of the decision by the decision-maker. Decisions may be made that lead to Coping Actions, Stabilizing, formal Sensing Actions, and Feedback.

(4) Stabilizing—those actions taken to adjust internal operations or to maintain stability and functional integration within an organization, in order to adapt to changes in the external environment. The results concerning this process were inconclusive in the present study, so further test of its contribution to the conceptual framework is needed.

(5) Communicating Implementation—those activities whereby decisions and resulting requirements are communicated to those individuals who must implement them. In addition to the straightforward transmission of orders or instructions, this process also includes "discussion and interpretation"—those communicative acts through which clarification is achieved and implications for action are discussed. Of particular importance in this process are those activities of individuals who relay instructions between the original decision-maker and the individual who ultimately implements the decision.

(6) Coping Actions—those activities involving direct action against external and internal environments. This process is concerned with the actual execution of actions at points of contact with the target environments. Accordingly, it is the ultimate determinant of effectiveness. Whereas all other processes influence the performance of Coping Actions, they, in turn, determine the effect of the organization upon the target environment.

(7) Feedback—those activities that both assist the organization to evaluate the effectiveness of its actions upon its environments and furnish information upon which adjustments and future actions can be based. In the present study, results concerning this process were inconclusive; because of its heuristic value the process has been retained in the conceptual framework until further information concerning its validity is obtained.

Competence is concerned with the quality of performance within an organization. Although each process must be performed at least to a minimal degree, the essence of Competence is quality—how well the processes are performed. The following criteria, which were used for scoring process performance in this study, illustrate the qualitative requirements of each process:

(1) Sensing
   (a) Accurate detection of all available information.
   (b) Correct interpretation of all detected information.
   (c) Accurate discrimination between relevant and irrelevant information.
   (d) Relevance to mission, task, or problem of all attempts to obtain information about the environment.

(2) Communicating Information
   (a) Accurate transmission of relevant information.
   (b) Sufficient completeness in transmission to achieve full and adequate understanding by recipient.
   (c) Timely transmission of information.
   (d) Transmission to appropriate recipients.
   (e) Correct determination of whether information should be transmitted.

(3) Decision Making
   (a) Correctness of decision in view of circumstances and available information.
   (b) Timeliness of decision in view of available information.
   (c) Consideration in the decision process of all contingencies, alternatives, and possibilities.

(4) Communicating Implementation
   (a) Accurate transmission of instructions.
   (b) Sufficient completeness to transmit adequate and full understanding of the actions required.
   (c) Timely transmission in view of both available information and the action requirements of recipient.
   (d) Transmission to appropriate recipients.

(5) Actions: Stabilizing, Coping, and Feedback
   (a) Correctness of action in view of both the operational circumstances and the decision or order from which the action derives.
   (b) Timeliness of the action in view of both the operational circumstances and the decision or order from which the action derives.
   (c) Correctness of choice of target for the action.
   (d) Adequacy of execution of the action.

Thus, Competence is the adequacy with which an organization performs its critical processes. When the processes are performed adequately, they assist an organization to be effective. When handled poorly, they may negate many positive effects contributed by efficiency in other areas.

It is apparent that Competence is mainly dependent upon the performance of people. Some technological assists, such as data-processing equipment and highly sophisticated communications equipment, may be provided, but the payoff in Competence ultimately reduces to the judgment and actions of key personnel, both individually and

collectively. Competence depends upon skills in acquiring and interpreting information; choices concerning to whom acquired information is to be communicated, as well as the accuracy and completeness of the communications; decisions concerning ways to cope with unusual or unanticipated situations; and the execution of actions resulting from such decisions—all performed at a high level of sensitivity and coordination. These are uniquely human activities which can only be assisted, and not supplanted, by technology.

IMPLICATIONS

The processes that have been subsumed under the rubric "Organizational Competence" are not new inventions. They have always existed, and people who work in organizations have usually been aware of them to some degree. Certain of them, mainly Decision Making and Communicating Implementation, have received some attention in training courses for leaders and managers. However, for the most part, these functions do not receive much direct emphasis in organizations, certainly not as the integrated system of processes they appear to be.

Reasons for this lack of emphasis are difficult to determine. A possible reason is the ubiquity of the processes. They are always present in organizations and their obviousness may lead to neglect. A more probable cause is the fact that organizational processes are the products of human behavior and, accordingly, are less tangible, more ambiguous, and less susceptible of control than more concrete aspects such as procedures or equipment. For whatever reason, the fact remains that organizational processes have not received adequate attention in attempts to improve the performance of organizations.

The principal contribution of the present study is a concrete demonstration of the importance of Organizational Competence as a determinant of effectiveness, of the relative contributions of the various processes, and of the systematic relationships that exist among the processes, as well as the ways in which change and pressure affect their performance. It is now apparent that Competence plays a major role in the performance of organizations and, accordingly, warrants major attention in efforts to improve effectiveness.

RELEVANCE FOR MILITARY TACTICAL UNITS

Military tactical units are examples *par excellence* of organizations that must adapt readily to fast-changing environmental conditions. This requirement applies in all combat contexts, but is especially relevant for internal defense operations, where there is a premium upon quick reaction in uncertainty situations. The command and control system serves as the brain of a tactical unit, collating all information and sending appropriate instructions to personnel who are in contact with the enemy. The extent to which this system functions flexibly, efficiently, and effectively determines the ability of the unit to overcome its tactical environments. Competence is the quality of performance of the command and control system. Therefore, the importance of Competence for tactical units seems self-evident.

The development of Competence within a tactical unit can be expected to result in (a) a more smoothly functioning command and control team, (b) adjustment to changes in the tactical environment with a minimum of wasted effort, lost motion, or reduced effectiveness, and (c) maintenance of higher levels of effectiveness under the pressures of combat.

RELEVANCE FOR OTHER ORGANIZATIONS

Aside from the stresses and dangers of combat, the greatest difference between tactical units and other organizations, both military and civilian, is the time frame within which problems occur and must be solved. In contrast to tactical units, the time span for operations and problems in other types of organizations may extend over weeks, months, or even years, and problems may overlap so that it is not always possible to know where one begins and another ends. In combat, the operations of tactical units are usually more clearly demarcated and shorter in duration.

The above differences make processes in nontactical organizations somewhat more ambiguous, often complex, and sometimes difficult to trace. Nevertheless, attention to Competence appears to be equally, if not more, important for these organizations than for tactical ones. The increasing rapidity with which change is occurring in modern society has led several noted authorities, especially Bennis (6, 14, 15), to emphasize the urgent necessity for organizations to learn to adapt flexibly to continuously fluid conditions.

Current notable examples are requirements for the military establishment to adapt to changed sources of its personnel and new values in society and for aerospace firms to remain viable despite reduced demands for their traditional products and services. Almost every industrial firm is faced with the necessity for accommodating to rapidly shifting markets, changing technology, and heightened public concern about pollution, ecology, and damage to the environment. Governments must stay abreast of their citizens' needs and desires that change almost daily, and even educational institutions must continually modify goals and operations to meet the demands of constantly shifting constituencies. Under such conditions, organizational survival requires fine sensitivity to the often subtle cues provided by environments, the ability to read such cues promptly and accurately, and the capacity for rapid but efficient modifications of internal functions so that new developments can be met and mastered as they arise.

The results of this study do not suggest that Competence is a panacea for all the problems that may beset an organization. However, it appears that the quality of process performance is a critical factor in all types of organizations and attention to Competence development should result in improved effectiveness.

THE DEVELOPMENT OF COMPETENCE

In many organizations, Competence is less than adequate because little systematic attention is given to the quality of process execution. Instead, attempts to improve effectiveness take the form of increased emphasis upon regulated and formal responses that control variability and, thus, insure reliability in performance. There is a preference for the certainty of standardized procedures with their clearly demarcated and logically related stages. Accordingly, organizational processes, which are less tangible and more ambiguous, may not receive the attention their importance warrants.

Formal procedures are imperative for the effective functioning of any organization, and the results of this study do not argue for neglecting them. However, over-reliance upon standardized responses leads to organizational rigidity. Effectiveness in the fast-changing environments of today requires high levels of flexibility, a quality that is essential in uncertainty situations and that has its source in what has been called in this study Organizational Competence.

Much of the reason for inattention to organizational processes can be traced to the scarcity of research concerned with them. Although theorists have long contended that

processes may be the key to understanding organizations, process-oriented studies have been rare. Accordingly, genuine knowledge about organizational processes and their relationships to effectiveness is in short supply.

The conceptual framework presented here under Organizational Competence and the results of this study appear to offer one means for overcoming this problem. The Competence components and their processes, together with the methodology for their analysis, provide concrete ways for assessing the internal functioning of organizations and for relating such functioning to both antecedent causal factors and ultimate achievement.

Organizational Analysis

The concepts subsumed under Organizational Competence offer potential for the diagnosis of organizational functioning and for the correction of dysfunctional aspects. Thus, it is possible to specify which individuals, positions, or organizational units should perform each process. Such specification would enable the development of techniques and training uniquely designed to enhance the process performance of each individual or unit.

It is also possible to evaluate positions, individuals, and units in terms of how well the processes are performed, thus permitting identification of points within the organization that are functional or dysfunctional according to the quality of their process performance. Identification of dysfunctional points could lead to corrective action, retraining, or abolition of positions.

Finally, the concepts provide a workable framework for periodic self-evaluation by an organization. In military tactical units, training exercises followed by process-centered critique and self-evaluation by command and control personnel should greatly enhance Organizational Competence of the unit. For other types of organizations, periodic examination and critique of process performance will furnish a sound basis for developmental efforts.

Organizational Design

The way in which an organization is designed can have far-reaching implications for process performance. Organizational structure—lines of authority, responsibility, and communication—can either enhance or impede process performance. For example, every link in the chain of command contains potential for both delay and distortion of communication. Therefore, a structure that consists of numerous hierarchical levels possesses a built-in mechanism for degrading the quality of Communicating Information and Communicating Implementation, unless specific roles or techniques for facilitating communication are designed into the organization.

In a similar vein, an organization that makes sense according to the "logics of organization" may never function effectively because the process requirements of its particular mission were never taken into account. Structures that will be most conducive to process performance will vary according to the missions, objectives, and required activities of the organizations. Ideally, process requirements would be determined prior to design of an organization and process considerations would be taken into account equally with the more usual functional aspects.

Consideration of process requirements in the design of organizations may lead to the establishment of special units or departments that are specifically charged with responsibility for performance of certain processes. An already existing sample of such special units in military organizations is reconnaissance platoons that are specifically designed to perform what are, in effect, sensing activities. In business firms, market research departments serve a part of the sensing function.

Training

Although problems and goals differ according to types, purposes, and missions of organizations, the processes that comprise Competence are universal. Accordingly, the question is not whether the processes occur, they must be performed to some extent in any organization that is at all functional. Rather, the question is how well the processes are executed and how they are coordinated to result in total organizational performance. Since they must occur, an equally important issue is whether the processes will be allowed to operate unmonitored and uncontrolled, or whether personnel will be specifically trained, both individually and collectively, to perform and control them properly.

Improvement in Competence can best be achieved through programs that are specifically oriented toward process training and process development. That is, the development of Competence requires training programs with the specific objectives of developing skills in process performance and with content and methods designed to accomplish these objectives. Competence improvement cannot be accomplished well when it is a subsidiary activity in programs or blocks of instruction devoted to other purposes.

The effective performance of dynamic organizational processes requires that individuals and groups see and feel their actions in realistic situations and have the opportunity to obtain feedback concerning results of the actions so that further modifications may be accomplished. Accordingly, experiential training is the technique of choice for Competence development. Methods such as role playing and role simulation, administered in realistic organizational settings, supplement conceptual analyses of Competence and its components, and provide opportunities for students to vividly experience the results of their actions and relate their behavior to that of other organizational members in a meaningful way. Knowledge of the requirements for effective process performance, when coupled with controlled experiences in execution, can be expected to result in decided improvement in the leadership and managerial performance of individuals.

Organizational Development

Despite the obvious value to be derived by individuals from Competence training, the greatest benefit for an organization is to be obtained from efforts to develop all of its elements in concert. Competence represents capability of the organization and is different from the sum of individual capabilities. Process performance involves organizational responses and the quality of any single response event is determined by the entire network of antecedent relationships and responses. This suggests that Organizational Competence can best be improved by efforts that focus upon developing the organization to function as a system.

In recent years, Organizational Development (OD) has achieved increasing prominence as an educational strategy (16, 17). OD is based upon the premise that the only viable way to change an organization is to change the actual system within which members work and live—that is, to modify the actual organization and its processes, mainly through efforts of members themselves, although the impetus may come from external trainers or consultants.

Organizational Development takes a variety of forms and focuses upon many different aspects of organizations, but central to all approaches is a strategy based upon developmental efforts carried out within an existing organization and during the course of ongoing activities. Through guided and controlled analyses, members examine their own activities and modify them in directions intended to improve the functioning of the overall organizational system.

Improvement in Organizational Competence appears to be best accomplished through a form of Organizational Development that would include (a) individual training in process performance; (b) team training in a simulated organizational setting; and

(c) internal development efforts based upon analysis of the Competence of the specific organization, continuing assessment of Competence performance, and periodic Competence training conducted in conjunction with other unit training programs.

The study reported here has demonstrated that Organizational Competence is a feasible means for opening the "black box" of an organization and for examining its internal functioning. Accordingly, Competence has important relevance for both research and application. With respect to research, the concepts of Competence, its components, and its processes offer a practical framework for understanding the dynamics of organizations. With respect to application, Competence provides a systematic and concrete framework upon which realistic training and organizational development can be based.

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AND
APPENDICES

LITERATURE CITED

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Appendix A

SUMMARY OF SIMULATE SCENARIO

I. Phase I (Orientation)

A. Objective. To describe the pre-simulation (previous 24 hours) history of TF 1-66 in sufficient detail to enable player personnel to participate knowledgeably as battalion command and control personnel.

B. Method. The orientation phase is conducted in two parts:

1. Part I—Players receive a two-hour orientation briefing on the afternoon prior to the simulation. Players are furnished the general and special situations, brigade operations order, brigade administrative order, battalion operations order, analysis of the area of operations, and an operations map designating boundaries for subordinate elements of TF 1-66. Colored slides showing typical terrain are shown. Staff journals covering important events in the past 24 hours are also provided. Subordinate unit commanders are provided information specific to their respective situations.
2. Part II—Players assemble in the battalion command post at 0830 on the day of simulation. New Battalion Commander receives an operations briefing by his staff and company commanders. Simulate date - 19 March.

C. Summary (previous 24 hours). TF 1-66 conducted a successful air assault into AO LEMON on 18 March. Company-size patrol bases were established. During the day, subordinate units performed patrolling operations near their bases. At night, two ambushes were established by each company. The intelligence picture is hazy. Staff journals reflect important events that occurred.

D. Outline of Events (previous 24 hours)

1. Landing zones secured.
2. Patrol bases secured.
3. Patrol operations initiated.
4. Personnel strength report submitted to Brigade.
5. Battalion logistics report submitted to Brigade.
6. Routine S1 and S4 activities.
7. Night ambushes established.
8. Civic action requests are minor and routine.
9. Battalion Commander violently ill. Evacuated by air to An Ky. Diagnosis: Hepatitis.
10. No direct contact with enemy units during period.
11. Brigade SITREP indicates no significant enemy activity in AO HAZE (Brigade area of operations).
12. All units conducted stand-to at 0505 hours.
13. New Battalion Commander arrives at 0800 19 March.

II. Phase II (Low Pressure)

A. Objective. To generate data representative of an Infantry battalion performing routine operations in a low-pressure internal defense environment.

B. Method. Present a series of probes that will elicit serious player involvement and cause TF 1-66 to respond in a realistic manner to events in its external and internal environments.

C. Summary. Simulate time: 0930-1145 hours. The primary activity in AO LEMON during Phase II is combat patrolling. B Company patrols toward HILL 870 (4547) with platoon-size units. All other units dispatch platoon-size patrols. Intelligence indicates enemy activity along the major ridge on B Company's western boundary. C Company becomes involved in a fire fight. All companies apprehend returnees and doubtful cases. Civic action play for all units. Warning order received by TF 1-66 at 1135 hours to be prepared to support TF 1-68 into AO LINEN. Phase II ends with FRAGMENTARY ORDER to conduct air assault into AO LINEN.

D. Outline of Events

1. Two probes per hour from each Brigade staff section.
2. Each platoon reports important incidents as they occur; otherwise, reports are submitted hourly.
3. One platoon of Company C engaged in fire fight; 2 KIA, 5 WIA.
4. One platoon of each company apprehends or captures PWs, returnees, or doubtful cases.
5. One platoon of Company A makes contact with a patrol from TF 1-67 near eastern boundary.
6. All platoons receive intelligence indicating VC are operating in area. Sources are district or province officials, villagers, recently used trails, small caches of supplies, and abandoned squad or platoon base camps.
7. Company B elements receive mortar and sniper fire as they patrol toward HILL 870.
8. The water pump for the battalion water point becomes disabled.
9. Brigade CO lands his C&C aircraft to determine progress of A Company. In discussion with a platoon leader, he stresses the importance of either destroying or evacuating all caches of supplies that are discovered and says that all VC fortifications are to be rendered unserviceable if possible.
10. Upon discovering a deserted 50-man underground hospital, a different platoon of Company A requests assistance in destroying it.
11. Support Platoon leader recommends that a road block at O KA (5755) on Hwy. 517 be repaired.
12. Challenge and password compromised. Brigade furnishes new one for 19 March.
13. Battalion Reconnaissance Platoon leader requests use of Scout Dog Team to aid in search of suspected VC training area.
14. Battery Commander reports that 420 HE and 72 illuminating rounds have been fired during period 182400 - 190600 March.
15. Heavy mortar platoon leader asks permission to move his platoon from the base camp to Pheiw Cha (5148).
16. Warning order to move TF 1-66 to AO LINEN is sent by radio to battalion.
17. FRAG order to conduct air assault into AO LINEN and aerial photographs of landing zones are dispatched to battalion by messenger.

III. Phase III (Moderate Pressure)

A. Objective. To generate data representative of an Infantry battalion performing combat operations in a moderate-pressure internal defense environment.

B. Method. Present a series of probes that will elicit organizational processes associated with changes in mission and environment under moderate-pressure conditions.

C. Summary. Simulate time: 1146-1400 hours. In Phase III, TF 1-66 prepares and conducts an air assault into a new area of operations to secure and hold blocking positions as part of a brigade encirclement operation. The principal player activity consists of preparing and issuing the air assault order to subordinate units and reacting to ongoing activities. All patrol plans are canceled upon receipt of the warning order. Units assemble at nearby pickup zones for air assault into AO LINEN. Mission-oriented probes continue to be inserted by both brigade and company controllers. Phase III begins with receipt of the brigade FRAG ORDER and ends when subordinate units have landed in their new AO.

D. Outline of Events

1. Brigade FRAG ORDER and aerial photographs of landing zones in AO LINEN received by TF 1-66.
2. Battalion Commander and staff prepare the operations order for the air assault into AO LINEN.
3. Brigade notifies TF 1-66 that aircraft to support the operation can be expected NLT 1340.
4. Battalion issues the air assault order to company commanders.
5. Company commanders issue the air assault order to platoon leaders.
6. Platoon leaders report their movements and arrival times at company marshaling area.
7. Brigade furnishes additional intelligence and operations information to battalion staff.
8. Company Executive Officers report to Company Commanders that all elements of each company are airborne.
9. TF 1-66 is airborne.
10. Gunships delivering preparatory fires on and around LZ RED report strong ground fire from area. Recommend divert to LZ RED-A.
11. All other gunships report other LZs free of enemy activity.
12. TF 1-66 lands successfully in LZ RED-A, WHITE, BLUE, YELLOW, and GREEN.

IV. Phase IV (High Pressure)

A. Objective. To generate data representative of an Infantry battalion conducting combat operations in a rapidly changing, high-pressure internal defense environment that threatens the survival of the unit.

B. Method. Present a series of probes that will approach task overload and cause TF 1-66 to respond in a realistic manner to events that threaten the survival of the command.

C. Summary. Simulate time 1401 - 1615 hours. TF 1-66 is required to establish company- and platoon-size blocking positions to prevent the escape of a battalion-size enemy force that is being pursued by two other battalions of 1st Infantry Brigade. Unknowingly, CO 1st Brigade has ordered TF 1-66 into blocking positions just across a river from an enemy regimental-size base camp, to which the pursued battalion is withdrawing. After touchdown, TF 1-66 is subjected to a series of strong attacks by both the withdrawing enemy battalion and units from the base camp. The purpose of the attacks is to destroy TF 1-66, in order to permit the escape of the withdrawing unit and to enable all enemy elements to break contact and move, in darkness, to a new sanctuary. The brigade commander, realizing the gravity of the situation, commits TF 1-67 to relieve enemy pressure from TF 1-66. Phase IV begins with the injection of information concerning movement of elements into planned blocking positions and ends with the arrival of TF 1-69 into AO LINEN.

D. Outline of Events

1. Leaders of each leading platoon of each company report no enemy contact after departure from their respective LZs toward nearby blocking positions.
2. Brigade CO informs CO, TF 1-66 that both TF 1-68 and TF 1-69 have contact with what is believed to be a full enemy battalion that is withdrawing along one route in a southwesterly direction toward blocking positions occupied by TF 1-66.
3. All elements report arrival at blocking positions.
4. A/1-46 Arty reports they are ready to accept fire missions.
5. One rifle company receives mortar and machinegun fire from a direction opposite to that occupied by the pursued enemy battalion.
6. Another rifle company's outpost is driven in by the enemy battalion.
7. A third rifle company reports contact with an enemy patrol in a direction opposite to the primary threat.
8. FAC reports enemy movement in a sector opposite to the pursued enemy battalion.
9. PW states that his battalion's base camp is to the southwest of TF 1-66 blocking positions.
10. Elements of the withdrawing enemy battalion make contact with the rifle company reporting the patrol action (Item 7, above).
11. TF 1-66 is under heavy ground attack. All units are engaged.
12. Brigade reports that a district official states that the area to the southwest of TF 1-66 is an enemy regimental-size base camp.
13. All company commanders receive calls from their various platoons concerning defensive fires, casualties, penetrations, requests for ammunition, and close air support.
14. Controllers for two companies report that at least one platoon each has lost contact with the company CP.
15. The survival of TF 1-66 is threatened.
16. TF 1-67 is committed to relieve the pressure on TF 1-66.
17. Phase IV terminates.

Appendix B

PROBE ELEMENTS

IV Probe Manual

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
63	PE-39-II	0	Bn S3	Bde S3	1429	Radio	Yes	BLUE HUEY

Situation: A gunship, after overflying the village of BONG-ME (45648), climbs sharply toward the top of hill held by the unit landing on LZ BLUE. The ship is hit by ground fire and crashes into the jungle canopy vicinity 441647. This position is near the point occupied by the listening post (LP) established by the right flank platoon of BLUE Company.

Message: I just got a call from DRAGONFLY that a gunship has been shot down at 441647. The ship was hit by ground fire coming from the side of mountain just below _____ Company's position. Aircraft are overhead to provide what fires they can. We need a ground unit to link up with the ship as quickly as possible.

Expected Recipient Action	Subsequent Controller Responsibility
1. Notify Unit CO. 2. Attempt to rescue crew of the downed aircraft.	1. This information was also injected by a company controller in the area where the incident occurred.

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
69	PE-39-III	0	Unit Comdr	LZ BLUE	1430	Radio	Yes	BLUE HUEY

Situation: A gunship, after overflying the village of BONG-ME (435648) (village is unnamed on map), climbs sharply toward the top of the hill held by the unit landing on LZ BLUE. The ship is hit by ground fire and crashes into the jungle canopy vicinity 441645. This position is near the point occupied by the listening post (LP) established by the right flank platoon of BLUE Company. The platoon leader (or acting platoon leader), right flank platoon reports.

Message: One of the gunships just went in. I think it was hit by machinegun fire. It crashed just below my position. I'm going to rescue the crew.

Expected Recipient Action	Subsequent Controller Responsibility
1. Notify Bn S3. 2. Attempt to rescue ship crew; protect aircraft if possible.	

IV Probe Manual (Continued)

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
74	PE-39-IV	0	Unit Comdr	LZ BLUE	1432	Radio	Yes	BLUE HUEY

Situation: BLUE smoke is coming up through the canopy to mark the position of the crashed aircraft. The platoon leader reports.

Message: I see BLUE smoke coming through the canopy where the chopper went in. No change in coordinates.

Expected Recipient Action	Subsequent Controller Responsibility
1. Reports information to Bn.	

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
77	PE-39-V	0	Unit Comdr	LZ BLUE	1435	Radio	Yes	BLUE HUEY

Situation: The gunship crashed into the thick jungle canopy and fell to the jungle floor. The two pilots and crew chief are alive but injured. One crew member was killed by the ground fire. Members of the right flank platoon reach the position before the VC.

Message: We have arrived at helicopter. It came through the canopy in better shape than I would have expected. One crew member is KIA. There are three others badly wounded. We are trying to get them out of the plane. I have posted local security. The outfit that shot the HUEY down is probably moving this way. BLUE smoke is all over the place. They must have thrown a case of the stuff. What shall I do with the plane?

Expected Recipient Action	Subsequent Controller Responsibility
1. Notify Bn of the situation.	1. Carry out CO's order regarding the aircraft.

IV Probe Manual (Continued)

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
82	PE-39-VI	1	Unit Comdr	LZ BLUE	1438	Radio	Yes	BLUE HUEY

Situation: The VC attempting to reach the downed aircraft have been hampered in their uphill climb to reach the crash site. In their haste, and believing that they were first on the scene, the Viet Cong are surprised by the U.S. security force. One VC is killed and another wounded through the right shoulder and arm. The latter individual is captured. The platoon leader reports.

Message: I have made contact with an unknown VC force. Killed one and captured one. Can't get one of the pilots out of the BLUE HUEY. He is unconscious—maybe dead. I plan to evacuate WIAs and PW; then pull in my security group and fight a rear guard action back to my position.

Expected Recipient Action	Subsequent Controller Responsibility
1. Unit Commander should lay on DUSTOFF to evacuate aircraft, crew members, and PW.	

Input Number	Code Number	Input		Controller Responsibility	Injection Time	Method of Injection	Follow Up Required	Code Name
		Target	Recipient					
1	PE-39-VII	1	Unit Comdr	LZ BLUE	1442	Radio	Yes	BLUE HUEY

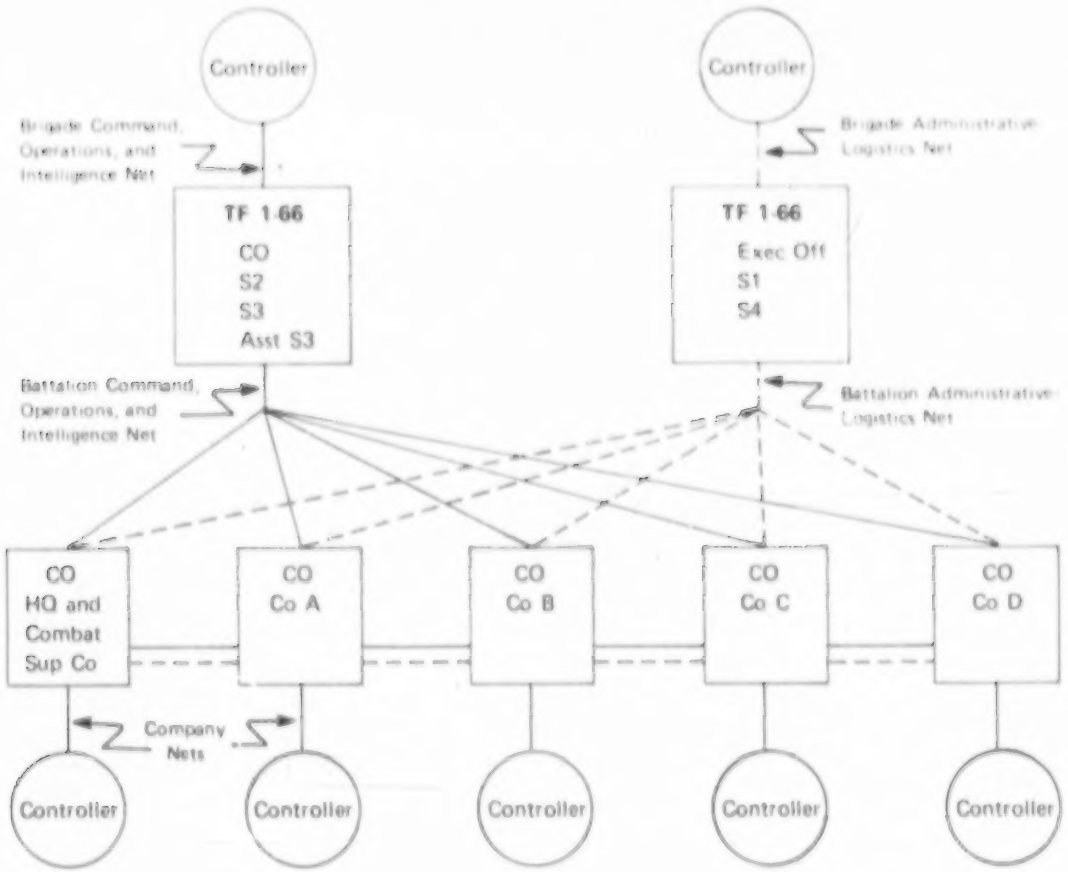
Situation: Aircraft crew personnel have been removed from the BLUE HUEY. The carrying party has started the uphill climb to the platoon position. Firing continues around the scene of the crash.

Message: I have secured all crew members. They are being carried back to position. There are more VICTOR CHARLIES here than I thought. Fire is picking up. They have one machinegun firing into the BLUE HUEY. I'm pulling back. I was not able to destroy radios, weapons, or ammunition. Tell DRAGONFLY to work the place over.

Expected Recipient Action	Subsequent Controller Responsibility
1. Request DRAGONFLY support.	

Appendix C

SCHEMATIC OF SIMULATED RADIO NETS

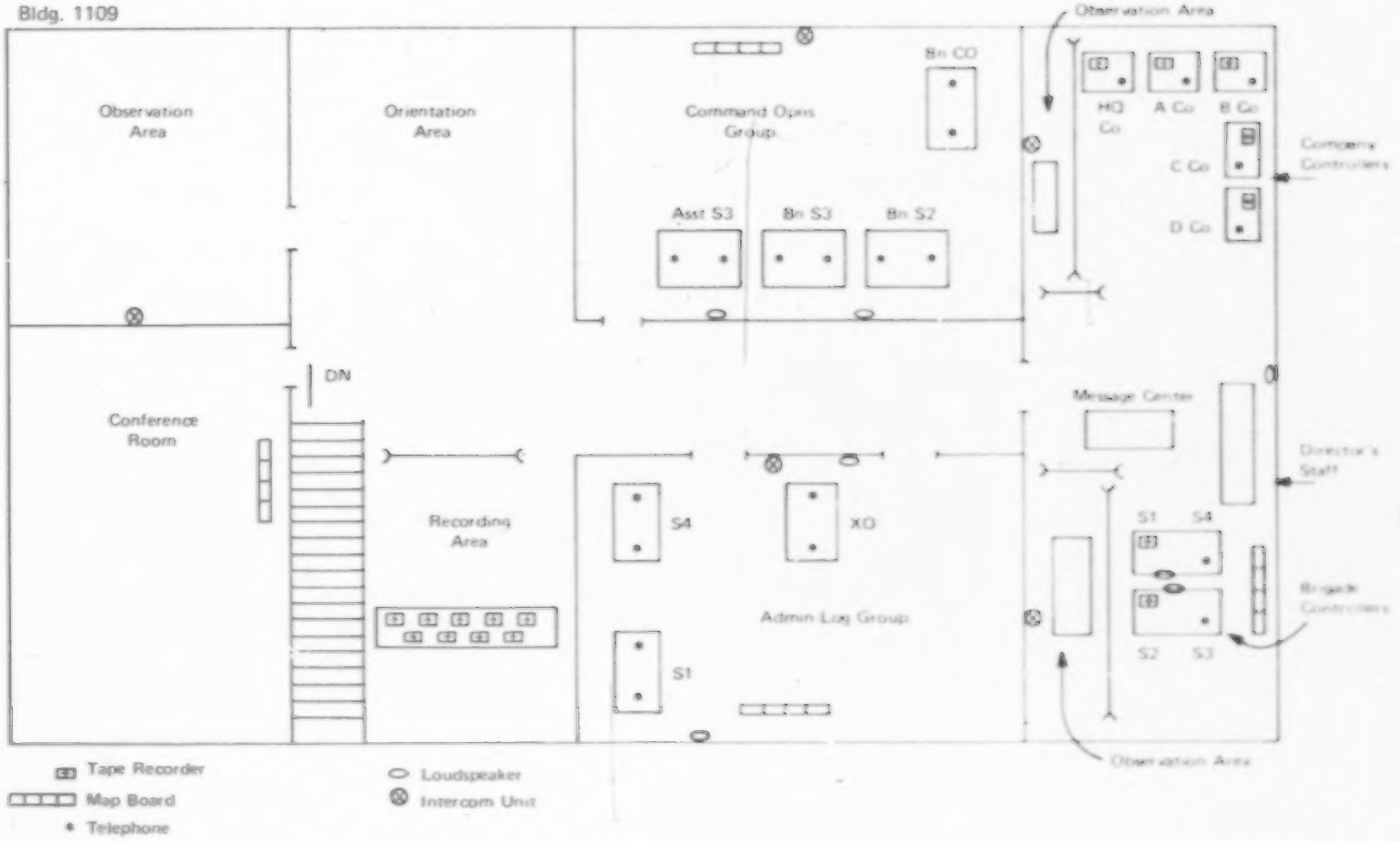


Appendix D

LAYOUT OF EXPERIMENTAL AREA

Battalion Headquarters and Control Staff

Bldg. 1109

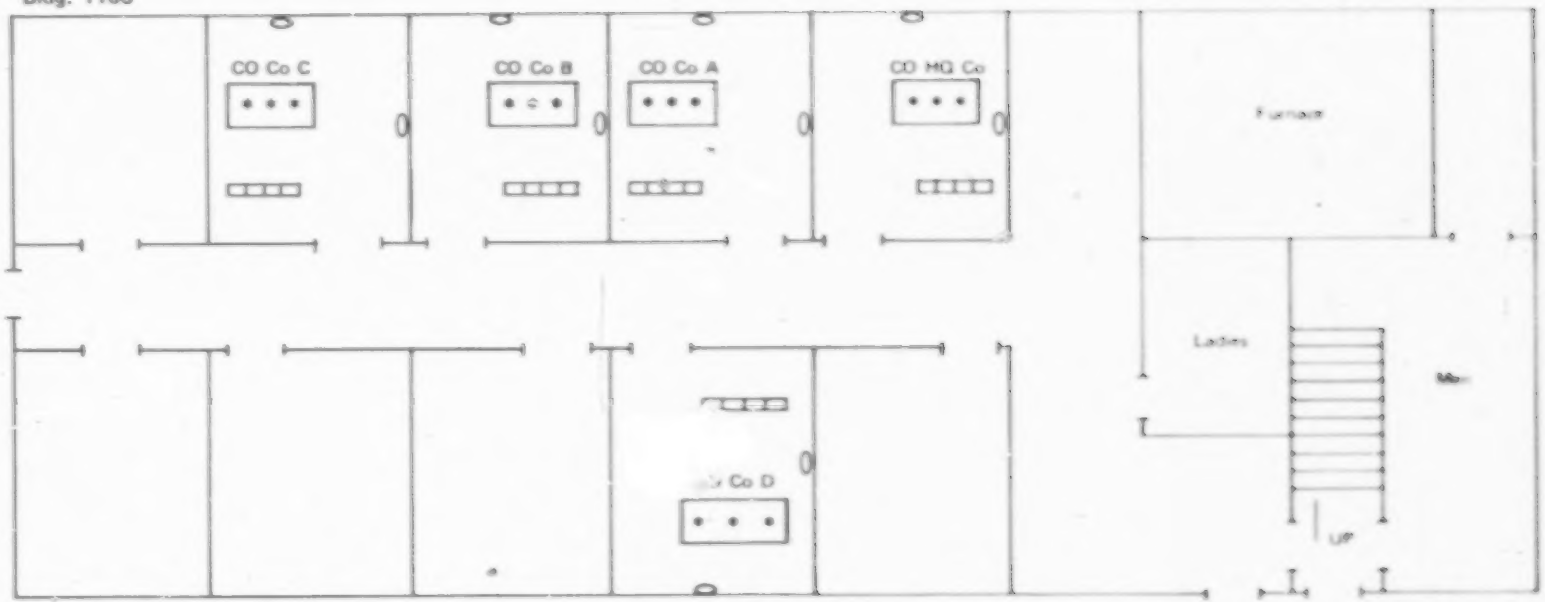


(Continued)

(Continued)

Company Commanders

Bldg. 1108



- Telephone
- Loudspeaker
- Map Board

Appendix E

QUESTIONNAIRE ITEMS USED TO ELICIT PLAYER EVALUATION OF THE SIMULATION[1]

1. How interesting did you find this exercise, compared to other CPXs in which you have participated?

1	2	3	4	5	6	7
A Lot Less Interesting	Less Interesting	Slightly Less Interesting	About the Same	Slightly More Interesting	More Interesting	A Lot More Interesting

2. How realistic or unrealistic were the problems with which you had to deal in this exercise?

8	7	6	5	4	2	1
Extremely Realistic	Very Realistic	Quite Realistic	Slightly Realistic	Quite Unrealistic	Very Unrealistic	Extremely Unrealistic

3. How likely is it that battalions that are effective in this exercise will also be effective in a real situation?

1	2	3	4	5	6	7	8
Extremely Unlikely	Very Unlikely	Quite Unlikely	Unlikely	Likely	Quite Likely	Very Likely	Extremely Likely

4. In our battalion, the degree of player involvement in our task was:

6	5	4	3	2	1
Very High	High	Slightly High	Slightly Low	Low	Very Low

5. How much pressure did you feel in this exercise from its beginning up to the receipt of FRAG ORD 30-1?

7	6	5	4	3	2	1
Extreme	Very Much	Considerable	Moderate	Little	Very Little	None At All

[1] Numbers in the response space for the various alternatives are the values assigned to the alternatives and did not appear in the actual questionnaire.

6. How much pressure did you feel in this exercise from the receipt of FRAG ORD 30-1 up to the time you moved to blocking positions in your new AO?

7	6	5	4	3	2	1
Extreme	Very Much	Con-siderable	Moderate	Little	Very Little	None At All

7. How much pressure did you feel in this exercise from the time you moved to blocking positions in your new AO to the end of the problem?

7	6	5	4	3	2	1
Extreme	Very Much	Con-siderable	Moderate	Little	Very Little	None At All

Appendix F

PROBE MANUSCRIPT

Group No. 5 Probe No. 75 Probe Name BLUE HUEY

Contact No. 390
Time: 1415

CHARLIE 6 this is CHARLIE 3 Over./CHARLIE 6. Over./This is CHARLIE 3, 1415. I have located a trail that does not exist on my map. It leads down from the rear of my position toward the river. It doesn't look as though it has been used too often. I've put a two-man outpost on it so I will not be surprised from my rear. I've also designated one of my machinegun teams to prepare an alternate position there. The trail leads to the unnamed village on the river, about 700 meters from here. It enters my position at 442648. Say skipper—one of my men says that you've captured a CHARLIE Officer. What did you find out from him? Over./We got some information that there is a company coming down this way that could be hitting us in about 15 minutes. Stand by and I'll get back to you. I've got to get up to higher right now. Out./

Contact No. 399
Time: 1430

CHARLIE 6 this is CHARLIE 3 1430 Over./This is CHARLIE 6 Over./This is CHARLIE 3 Uh—one of the gunships just went in. I think it was hit by machinegun fire. It crashed just below my position. I'm going to rescue the crew. Over./This is CHARLIE 6, say again just exactly where it went in. Over./This is CHARLIE 3, I estimate that it went in at 441645./CHARLIE 6, OK, gain contact with your moving element out there and have them go over and check that area out. I don't want you to send any men out there now. Over./This is CHARLIE 3, Roger, I'll divert them from their mission of contact patrol to go down and get that helicopter. Over./This is CHARLIE 6, Roger, how far is it from their location, approximately, do you figure?/This is CHARLIE 3, I estimate about 250 meters. Over./This is CHARLIE 6, OK, good enough, have them go down there and see what the story is and then give me a call back. Over./This is CHARLIE 3 WILCO. Out./

Contact No. 402
Time: 1432

CHARLIE 6 this is CHARLIE 3 1432. Over./This is CHARLIE 6 Over./This is CHARLIE 3, I see blue smoke coming through the canopy where the chopper went in. No change in location. Over./This is CHARLIE 6, Roger. Out./

Contact No. 649
Time: 1433

DRUMFIRE 3 this is DANGER 3 1433. Over./This is DRUMFIRE 3, Roger. In addition to my request my 31 has given you for air, Alpha Co. is now in contact with at least two squads, maybe more. This goes along with your intelligence there that they are trying to break through that position. I want to request gunships. The commander thinks they will work better through the canopy in that area. What's the chances

of getting them ASAP. Over./This is DANGER 3, WILCO. Mallard is laid on. We've got three Foxtrot 100s coming in from that Alpha element now. Do you want that strike reported? Over./Negative. That should have been laid on for Delta Company. Over./This is 3, firm. That unit is en route to your Delta Co. position. It should be coming up on their frequencies now. Also, I received a request from your 31 for an air strike on to Alpha area along a trail that they suspect VC are operating along. Over./Roger. That suspicion is now confirmed with gunfire, but the priority of air still goes to Delta. If you have more than one Mallard, it can conduct multiple strikes and I'll take air in both locations./This is 3. Affirmative on that. The Mallard is coming in now at both locations. The ETA now in the Alpha area should be about 05 min./Roger. Forget the gunships; I'd rather have the air. I didn't know that you had multiple Mallards. Priority to Delta and the rest of it to Alpha. Just keep it coming and we'll turn it off when we're done with it. Over./This is 3. Roger, I have further traffic for you. I just got a call from Dragonfly that one of their gunships has gone down at coords, I read, 441647. The ship was hit by ground fire coming from the side of the mountain just below your CHARLIE Co. Aircraft are overhead to provide such fire as they can. We need a ground unit to link up with the ship as quickly as possible. Over./Roger, wait on, let me plot that out and see where it fits. Out.

Contact No. 959

Time: 1435

CHARLIE 6. This is DRUMFIRE 3. Over./This is CHARLIE 6. Over./Be advised that a gunship just shot down in your vicinity coordinates 441647, which is on your route to your blocking position. 6, would like you to go to that area and en route to your mission—in other words, along with your regular mission of taking the blocking position, also check out that area as soon as you can. There are gunships above to give you more support, so they'll be coming up on your push very shortly. Over./This is CHARLIE 6. Roger. I've already gotten a report on the gunship, uh, I've got my three element over to check out the situation. I still have two KIA and the RED LEG element is out of commission. So far all I've had is sporadic gunfire around here since putting that fire in the air. Over./Roger that. You are in contact with Mallard now. Is that correct? Over./This is CHARLIE 6. That's affirm. Over./Roger. Continue to fight the war and let us know what you need. Over./CHARLIE 6. Roger. Out./

Contact No. 403

Time: 1436

CHARLIE 6, this is CHARLIE 3 at 1436. Over./CHARLIE 6, this is CHARLIE 3 at 1436. Over./6, over./This is CHARLIE 3 at 1436. We arrived at uh—my squad has arrived at the helicopter. They came through the canopy in pretty good shape. One crew member is KIA. There are three others badly wounded. We are trying to get them out of the plane. I have posted local security around it. The outfit that shot the Huey down is probably moving this way. BLUE smoke is all over the place. They must have thrown a case of the stuff. What shall I do with the plane? Over./This is CHARLIE 6, OK, you said that the plane is still in fairly good condition?/This is CHARLIE 3, uh—negative. It is pretty badly beat up, but it is a little better than I figured it would be. Over./This is CHARLIE 6, OK, get hold of the wounded. Bring them toward this location. Have you got anything like an incendiary or anything, uh, toss it out in the downed chopper. You are

CHARLIE 3. Is that correct?/This is CHARLIE 3. That's affirmative. I'll have the helicopter destroyed and evacuate the wounded. Over./This is CHARLIE 6, Roger. Let me know when you get back to this location. I got a DUSTOFF coming in now. Over./Roger. Out./

Contact No. 405
Time: 1438

CHARLIE 6, this is CHARLIE 3 1438. Over./This is CHARLIE 6. Over./This is 3. My squad has made contact with an unknown VICTOR CHARLIE force. Killed one and captured one. Can't get one of the pilots out of the BLUE HUEY. He is unconscious—maybe dead. I plan to evacuate the wounded and the PW, then pull in my security group and fight a rear guard action back to my position. Over./This is CHARLIE 6. Go ahead and carry on./3 WILCO. Out./

Contact No. 409
Time: 1442

CHARLIE 6, this is CHARLIE 3 1442. Over./This is CHARLIE 6. Over./This is 3. My squad secured all crew members. They are being carried back to position. There are more VICTOR CHARLIES down there than we thought. Fire is picking up. They have one machinegun firing into the BLUE HUEY. I'm pulling back. I was not able to destroy radios, weapons, or ammunition. Tell DRAGONFLY to work the place over since they are overhead already. Over./This is 6, Roger that. What's the coordinates, approximately, for that? Over./This is CHARLIE 3, uh, I gave you coordinates of the downed chopper as 441645. There is blue smoke all over the place down there. Over./CHARLIE 6. Out./

Contact No. 971
Time: 1446

DRUMFIRE 3, this is CHARLIE 6. Over./This is DRUMFIRE 31. Go./This is CHARLIE 6. On the downed chopper, we've got the people out of it; however, there are quite a few VICTOR CHARLIES down there. There are gunships right overhead. They can probably see the area. It's covered with BLUE smoke. I'd like to get someone down there and put some fire there. Over./This is DRUMFIRE 31. If the gunships are over your area raise them on your freq. and call them in. Over./Roger that. I don't think they're on this push; I think they're on yours. Over./This is DRUMFIRE 31. Affirmative on that. I'll try to use the freq. Over./This is 6. Roger. Out./

Contact No. 656
Time: 1446

DANGER 3, this is DRUMFIRE 31. Over./This is DANGER 3 1446. Over./This is DRUMFIRE 31. Have your gunships up in the air come on CHARLIE's push? There are a few circling in that sector; heavy VC contact going on near that downed helicopter. Over./This is 3, WILCO on that. I'll have DRAGONFLY come in on CHARLIE's push. Over./Roger. Out./

Contact No. 412
Time: 1447

CHARLIE, this is DUSTOFF. Over./This is CHARLIE 6. Over./CHARLIE, this is DUSTOFF. Uh, I'm on your push. Where do you want me to blow it? Over./This is CHARLIE 6. Is this the same DUSTOFF that I was talking to before? Over./ Correction, CHARLIE. This is DRAGONFLY. I am, uh, I have armed gunships; where do you want me to shoot? Over./This is CHARLIE 6. OK, look down around grid coordinates 441645. You should see a lot of blue smoke rising around that area. There is a downed chopper down there. Uh, the radios have not been destroyed and there is a lot of good equipment. CHARLIE is closing in on it. I would like you to spray that area real good. Over./This is

DRAGONFLY. Roger. That was one of my people that went in there. I'll shoot up the area real good. Over./This is CHARLIE 6. Thank you. Out./

Contact No. 413
Time: 1448

CHARLIE 6, this is CHARLIE 3 at 1448. Over./This is CHARLIE 6. Over./This is CHARLIE 3. I'm back on the trail. Correction. My squad is back on the trail. Their position is 441647. CHARLIE is staying right with them. I'm convinced there must be a company of VC down there. They are probably stripping the BLUE HUEY with part of their force and bugging my squad with the other part. DRAGONFLY is throwing rockets into the area with driving attacks. Over./This is CHARLIE 6. Roger. You will get back to our position with no problem. Is that correct? Over./This is 3. I hope they can make it to my platoon with no sweat. Over./This is CHARLIE 6. Are they in contact now? Over./This is 3. That's affirmative. Uh, CHARLIE is pushing them and they are fighting a delaying action back to my position. I think they can make it OK. Over./This CHARLIE 6, OK. Roger. Out./

Contact No. 416
Time: 1453

CHARLIE 6, this is CHARLIE 3 at 1453. Over./CHARLIE 6, this is CHARLIE 3 at 1453. Over./This is CHARLIE 6. Over./ 6, this is 3, uh, the canopy is too thick for DRAGONFLY to be of—uh, effective. But I know how we can knock CHARLIE out and destroy the HUEY at the same time. The artillery can place direct fire on the BLUE HUEY and then along a line from there to my position. With enough rounds they can cut through the canopy and cut CHARLIE off. Have them mix DELAY with SUPER-QUICK. If they do a good job, I can go back in there and clean up. I'm nearly on my position now. Over./ This is CHARLIE 6. Roger. Now you bring your people back in. We'll try to get some artillery out there. First thing, I want a tight perimeter. You're not going to go back out there and try to police up anything. Bring your people back in and get in a tight perimeter. Over./This is 3. Roger. I just see my lead elements coming into the perimeter. Recommend that you shoot that direct fire artillery as soon as possible. Over./This is CHARLIE 6. Roger. Out./

Contact No. 417
Time: 1454

1454/CHARLIE 5, this is CHARLIE 6. Over./CHARLIE 5. Over./ This is CHARLIE 6. How are you coming on the LIMA ZULU? Over./ This is CHARLIE 5. We are working fast but—uh, I'm about ready to release this squad back to 4. He's shouting for them to move his mortars into the perimeter. Over./This is 6. Roger that. Go ahead and do that. What I want you to do is move over to 3's area and police up a radio. Get on REDLEG's push. You will call the fire on the area where the VC are all around the chopper down there. I want you to put some fire on that area. They'll know what to shoot. Do you Roger? Over./This is 5. I don't know their frequency—uh, how about having BLUELEG handle that? Over./This is 6. Negative. BLUELEG is over on the left flank. I want him to stay there. You move over there to 3's location and start calling in some fire. Over./This is 5. Roger. Out./Break—BLUELEG this is 5. Over./This is BLUELEG. Over./This is 5—uh, what's the frequency of your

fire direction center. It can't get artillery through them. Over./This is BLUELEG. Roger. I monitored last. I don't know artillery frequency but my fire direction net is 53.1 Over./This is 5. Roger. Can I get artillery through that? /This is BLUELEG. Roger. You can get artillery through them. Out./

Appendix G

EXCERPTS FROM CODER'S HANDBOOK

Section I

OVERVIEW OF THE SCORING SYSTEM

The purpose of this section is to provide a general understanding of the purpose, concept, and operations underlying the system for analyzing data generated by a simulated organization.

A. Purpose of the Scoring System

The purpose of this scoring system is to classify data generated by a simulated organization so that the activities of the organization can be systematically studied and evaluated. In this system, the material to be analyzed consists of all of the communications that occur within the organization during the time the simulate is in operation.

B. Concept

The overall concept involves experimenter control of inputs into the simulated organization and the analysis of all communications that occur within the organization in response to, or because of, the inputs. The analysis is accomplished by classifying all items of communication according to a system which related each item to its appropriate input and also indicated the function served by the communication in the activities of the organization.

C. Major Definitions

1. Probe. A Probe is a set of one or more input messages dealing with various aspects of a single topic or problem and sent from controllers to players in an organizational simulation. Each of the individual messages making up a Probe may be sent to a different organizational position (player) or all may be sent to one position, depending upon the experimental plan. Probes are developed as part of the scenario of the simulation and are programmed so as to fit realistically into the scenario. Each Probe will be given a code name which will be related to its main topic.

Prior to scoring the communication activities of an organization, scorers will be provided a list of the probes used in the simulate. This list of "probe contents" will be used in relating communications to the Probes to which they refer.

2. Probe Element. A Probe Element is a single input which is part of a Probe. Thus, a Probe consists of one or more Probe Elements. Probe Elements are numbered consecutively within each Probe and are signified by a Roman numeral.

3. Transcript. The term Transcript refers to the typed verbatim record of the communications of one group of players, i.e., one run of the simulate, which have been transcribed from the tape recordings, written messages, and journals generated during the run of the simulate. The Transcripts will be compiled separately for each of the various

modes of communication--Telephone and Radio Conversations, Face-to-Face Conversations, Conferences, Written Messages, and Journal Entries; however, Transcripts for the various modes covering one run of the simulate will be kept together to provide a complete record of the activities of that group. Thus, a complete transcript will contain many conversations and messages which occurred in several different modes of communication.

4. Contact. A Contact is defined as the material contained between two points in a Transcript where a single communication event begins (is initiated) and ends (is terminated). Typically, the shortest contacts will occur via the following modes of communication: Journal Entry, Written Message, Telephone or Radio. (Note: Although not strictly a communication between individuals, Journal Entries are included because they may provide additional insights into Contacts appearing elsewhere in the Transcript.) A Contact is indicated on the Transcript by horizontal pencil lines across the page, setting off one Contact from another. Contacts are signified by Arabic numerals.

5. Unit. A Unit is the material contained within one Contact where a single Probe is the continuous topic. A Unit begins where the Probe Content is first mentioned and ends when a new topic or Probe Content is introduced. Units may be shorter than Contacts and several Units may be included within one Contact. Of course, there will be many instances when a Contact will involve only one Probe Content, in which case the bounds of the Contact and the Unit will be identical. Units are indicated by red diagonal "slash" marks placed at the beginning and termination of each unit. The term "unitizing" describes the procedure whereby contacts and units are located and extracted from the Transcript. Units are signified by Arabic numerals within each Probe Manuscript.

6. Probe Manuscript. A Probe Manuscript is a compilation of all units dealing with one Probe. Probe Manuscripts are obtained by extracting all Units which refer to a single Probe Content and compiling them together into one manuscript. Thus, a Probe Manuscript contains in one document all of the material about a particular Probe.

7. Scoring. The term Scoring refers to the act of classifying each Unit according to a set of identification, content, and process categories and of recording these classifications on a Score Sheet (see Annex B).

CODING KEY

	Category	Coding Designation	Coding Number
Identification Categories:	Mode of Communication		(1-6)
		Telephone	1
		Radio	2
		Face-to-face	3
		Conference	4
		Written message	5
		Journal	6
	Participants (*Player)		(1-99)
	Bn S1 (DRUMFIRE 1)*		1
	Bn S2 (DRUMFIRE 2)*		2
	Bn S3 (DRUMFIRE 3)*		3
	Bn S4 (DRUMFIRE 4)*		4
	Bn XO (DRUMFIRE 5)*		5
	Bn CO (DRUMFIRE 6)*		6
	Bn Asst S3 (DRUMFIRE 31)*		7

CODING KEY *(Continued)*

Category	Coding Designation	Coding Number
Identification Categories:		
Company A (ALFA):		
ALFA Controller		10
1st Platoon (ALFA 2)		11
2nd Platoon (ALFA 2)		12
3rd Platoon (ALFA 3)		13
4th Platoon (Wpns) (ALFA 4)		14
XO (ALFA 5)		15
CO (ALFA 6)*		16
Artillery Forward Observer (ALFA REDLEG)		17
4.2 Mortar Forward Observer (ALFA BLUELEG)		18
Aviation Company Commander (DRAGONFLY ALFA Leader)		19
Company B (BRAVO):		
BRAVO Controller		20
1st Platoon (BRAVO 1)		21
2nd Platoon (BRAVO 2)		22
3rd Platoon (BRAVO 3)		23
4th Platoon (BRAVO 4) (Weapons)		24
XO (BRAVO 5)		25
CO (BRAVO 6)*		26
Artillery Forward Observer (BRAVO REDLEG)		27
4.2 Mortar Forward Observer (BRAVO BLUELEG)		28
Aviation Company Commander (DRAGONFLY BRAVO Leader)		29
Company C (CHARLIE):		
CHARLIE Controller		30
1st Platoon (CHARLIE 1)		31
2nd Platoon (CHARLIE 2)		32
3rd Platoon (CHARLIE 3)		33
4th Platoon (CHARLIE 4) (Weapons)		34
XO (CHARLIE 5)		35
CO (CHARLIE 6)*		36
Artillery Forward Observer (CHARLIE REDLEG)		37
4.2 Mortar Forward Observer (CHARLIE BLUELEG)		38
Aviation Company Commander (DRAGONFLY CHARLIE Leader)		39

CODING KEY *(Continued)*

	Category	Coding Designation	Coding Number
Identification Categories:	Company D (DELTA):		
	DELTA Controller		40
	1st Platoon (DELTA 1)		41
	2nd Platoon (DELTA 2)		42
	3rd Platoon (DELTA 3)		43
	4th Platoon (DELTA 4) (Weapons)		44
	XO (DELTA 5)		45
	CO (DELTA 6)*		46
	Forward Artillery Observer (DELTA REDLEG)		47
	4.2 Mortar Forward Observer (DELTA BLUELEG)		48
	Aviation Company Commander (DRAGONFLY DELTA Leader)		49
	Headquarters Combat Support Support Co. (HOTEL):		
	HOTEL Controller		50
	Antitank Platoon Leader (HOTEL 11)		51
	Heavy Mortar Platoon Leader (HOTEL 12)		52
	Recon Platoon Leader (HOTEL 13)		53
	Maintenance Platoon Leader (HOTEL 44)		54
	Air Control Team (HOTEL 55)		55
	Engineer Platoon Leader (HOTEL 31)		56
	Surgeon (HOTEL 21)		61
	Chaplain (HOTEL 22)		62
	Artillery Liaison Officer (HOTEL 33)		63
	Supply & Transportation Platoon Leader (HOTEL 40)		64
	XO, HQ & Combat Support Company (HOTEL 5)		65
	CO, HQ & Combat Support Company (HOTEL 6)*		66
	Communications Officer (HOTEL 10)		67

CODING KEY *(Continued)*

	Category	Coding Designation	Coding Number
Identification Categories:	Headquarters Combat Support Co. (HOTEL) *(Continued)*		
	Ground Surveillance Section (HOTEL 35)		68
	Aviation Company Commander (DRAGONFLY HOTEL Leader)		69
	1st Brigade:		
	S1 (DANGER 1)		71
	S2 (DANGER 2)		72
	S3 (DANGER 3)		73
	S4 (DANGER 4)		74
	XO (DANGER 5)		75
	CO (DANGER 6)		76
	S5 (DANGER 7)		77
	145th Aviation Bn Operations Center (DRAGONFLY Control)		79
	Radiotelephone Operator (RTO) LZ WHITE		81
	Radiotelephone Operator (RTO) LZ RED		82
	USAF Forward Air Controller (Mallard)		83
	C Co. 1/69 (Dugout CHARLIE)		84
	D Co. 1/69 (Dugout DELTA)		85
	Bn Conference Call (Incomplete) (List recipients contacted)		98
	Bn Conference (Complete)		99
Content Categories:	Topic of Unit		(1-999)
	Because of the possible introduction of unanticipated material by participants, it is necessary that the series of numbers for this category be "open-ended."		
	Time of Unit		(1-3)
		Past	1
		Present	2
		Future	3

CODING KEY *(Continued)*

	Category	Coding Designation	Coding Number
Content Categories:	Location of Unit		(1-2)
		External Environment	1
		Internal Environment	2
Process Categories:	Sensing		
		Passive Sensing	11
		Active Sensing	12
		Sensing Action	13
		Sensing of Brigade Decision	14
		Sensing of Recommendation	17
	Communicating Information		
		Communicating About Information Sensed	21
		Discussion and/or Interpretation	22
		Communicating Recommendation	23
	Decisions, Commands, Orders, and Instructions	D, C, O, and I leading to Active Sensing	31
		D, C, O, and I leading to Sensing Action	32
		D, C, O, and I leading to Stabilizing Action	33
		D, C, O, and I leading to Coping Action	34
		D, C, O, and I leading to Feedback Action	35
		Decision to Rescind Decision	36
	Stabilizing Action		41
	Communicating Implementation	Communicating About D, C, O, and I	51
		Discussion and/or Interpretation	52
	Coping Action		61
	Feedback Action		71

CRITERIA FOR SCORING PROCESS CATEGORIES

Scoring Numbers	Process	Criteria
	SENSING (Players receive or attempt to obtain information):	
11	Passive Sensing (External Environment)	(1) Player/Controller interaction only. (2) Player receives information from controller without asking for it. (3) Score of 1 in Column 0.
11	Passive Sensing (Internal Environment)	(1) Player/Controller interaction only. (2) Player receives information from controller without asking for it. (3) Score of 2 in Column 0.
12	Active Sensing (External Environment)	(1) Player/Controller interaction. (2) Player attempts to obtain information from controller (may result from decision by higher level). (3) Score of 1 in Column 0.
12	Active Sensing (Internal Environment)	(1) Player/Controller interaction only. (2) Player attempts to obtain information from controller (may result from decision by higher level). (3) Score of 2 in Column J.
13	Sensing Action (External Environment)	(1) Player/Controller interaction only. (2) Player attempts to obtain information from controller. (3) Formal action deriving from decision by organization. (4) Score of 32 in Column P with score of 1 in Column J for at least one prior unit. (5) Score of 1 in Column J.
13	Sensing Action (Internal Environment)	(1) Player/Controller interaction only. (2) Player attempts to obtain information from controller. (3) Formal action deriving from decision by organization. (4) Score of 32 in Column P with score of 2 in Column J for at least one prior unit. (5) Score of 2 in Column 0.
14	Sensing of Brigade Decision	(1) Player/Brigade Controller interaction only. (2) Limited receipt of unilateral directives from Brigade.

CRITERIA FOR SCORING PROCESS CATEGORIES *(Continued)*

Scoring Numbers	Process	Criteria
17	Sensing of Recommendation	(1) Player/Company Controller interaction only. (2) Limited to passive sensing of recommendations from units subordinate to Company Commander.
	COMMUNICATING INFORMATION (Transmission and discussion of information by players after it has been sensed and before a decision has been made about it.):	
21	Communicating Information About Information Sensed (External Environment) EXCEPTION - Where Bn informs Bde or where Co. Comdr informs Co. Controller about information sensed. Would have Player/ Controller interaction.	(1) Usually Player/Player interaction. (2) Limited to communication of sensed information. (3) Presence of an "informing" quality. (4) Occurs prior to a decision. (5) Score of 1 in Column 0.
21	Communicating Information Sensed (Internal Environment) EXCEPTION - Where Bn informs Bde or where Co. Comdr informs Co. Controller about information sensed. Would have Player/ Controller Interaction.	(1) Usually Player/Player interaction. (2) Limited to communication of sensed information. (3) Presence of an "informing" quality. (4) Occurs prior to a decision. (5) Score of 2 in Column 0.
22	Communicating Information-Discussion and Interpretation (External Environment)	(1) Player/Player interaction only. (2) Communication other than sensed information. (3) Occurs prior to a decision. (4) Score of 1 in Column 0.
22	Communicating Information-Discussion and Interpretation (Internal Environment)	(1) Player/Player interaction only. (2) Communication other than sensed information. (3) Occurs prior to a decision. (4) Score of 2 in Column 0.
23	Communicating Recommendation	(1) Player/Player interaction only. (2) Limited to relaying of recommendations made initially by units subordinate to company commanders.

CRITERIA FOR SCORING PROCESS CATEGORIES *(Continued)*

Scoring Numbers	Process	Criteria
	DECISIONS, COMMANDS, ORDERS, OR INSTRUCTIONS (Material reflecting the intention to take some kind of action):	
31	Decisions (etc.) Leading to Active Sensing (External Environment)	(1) Intended to lead to individual action to obtain information about the external environment. (2) Usually takes form of instructions from higher levels for lower levels to obtain information. (3) Usually Player/Player interaction. (4) First time decision appears in manuscript. (5) Score of 1 in Column 0.
31	Decisions (etc.) Leading to Active Sensing (Internal Environment)	(1) Intended to lead to individual action to obtain information about the internal environment. (2) Usually takes form of instructions from higher levels for lower levels to obtain information. (3) Usually Player/Player interaction. (4) First time decision appears in manuscript. (5) Score of 2 in Column 0.
32	Decisions (etc.) Leading to Sensing Action (External Environment)	(1) Usually Player/Player interaction. (2) Usually takes form of instructions from higher level to lower levels. (3) Intended to lead to formal organizational action to obtain information about the external environment. (4) First time decision appears in manuscript. (5) Score of 1 in Column 0.
32	Decisions (etc.) Leading to Sensing Action (Internal Environment)	(1) Usually Player/Player interaction. (2) Usually takes form of instructions from higher level to lower levels. (3) Intended to lead to formal organizational action to obtain information about the internal environment. (4) First time decision appears in manuscript. (5) Score of 2 in Column 0.

CRITERIA FOR SCORING PROCESS CATEGORIES *(Continued)*

Scoring Numbers	Process	Criteria
33	Decisions (etc.) Leading to Stabilizing Action	(1) Must be preceded by Coping Action or Decision (etc.) Leading to Coping Action to which it can be related as potential counteractor of negative effects. (2) Refers to internal environment only. (3) First time decision appears in manuscript. (4) Score of 2 in Column 0.
34	Decisions (etc.) Leading to Coping Actions (External Environment)	(1) Intended to effect a change in the external environment - to "do something." (2) First time decision appears in manuscript. (3) Score of 1 in Column 0.
34	Decisions (etc.) Leading to Coping Actions (Internal Environment)	(1) Intended to effect a change in the internal environment - to "do something." (2) First time decision appears in manuscript.
35	Decisions (etc.) Leading to Feedback Actions (External Environment)	(1) Intended to lead to formal action to obtain information about the outcome of a Coping Action. (2) Usually Player/Player interaction. (3) First time decision appears in manuscript. (4) Score of 1 in Column 0.
35	Decisions (etc.) Leading to Feedback Actions (Internal Environment)	(1) Intended to lead to formal action to obtain information about the outcome of Coping Actions and Stabilizing Actions. (2) Usually Player/Player interaction. (3) First time the decision appears in manuscript. (4) Score of 2 in Column 0.
36	Decision to Rescind Decision	(1) Limited to formal decision to rescind a prior decision. (2) Must be preceded by at least one prior decision of record to which it can be legitimately keyed.

CRITERIA FOR SCORING PROCESS CATEGORIES *(Continued)*

Scoring Numbers	Process	Criteria
41	STABILIZING ACTIONS (Actions intended to prevent potential negative effects to the organization which might occur because of Coping Action)	(1) Intended to prevent negative effects of Coping Action. (2) Must be preceded by or concurrent with a score of 53 in Column P. (3) Must be preceded by or concurrent with a score of either 34 or 61 in Column P for at least one unit to which it can be related. (4) Score of 2 in Column 0.
	COMMUNICATING IMPLEMENTATION (Transmittal and discussion of information instructions by players after decision has been made and before action is taken.)	
51	Communicating Implementation about Decisions (etc.) (External Environment) EXCEPTION - Where Bn informs Bde of a decision or action or where Co. Comdr informs Co. Controller of some decision or action taken elsewhere. Would have Player/Controller interaction.	(1) Traceable to a specific decision. (2) Limited to communication implementing a specific decision. (3) Presence of a "relaying" quality. (4) Occurs after decision and before action. (5) Usually Player/Player interaction. (6) Score of 1 in Column 0.
51	Communicating Implementation About Decisions (etc.) (Internal Environment) EXCEPTION - Where Bn informs Bde of a decision or action or where Co. Comdr informs Co. Controller of some decision or action taken elsewhere. Would have Player/Controller interaction.	(1) Traceable to a specific decision. (2) Limited to communication implementing a specific decision. (3) Presence of a "relaying" quality. (4) Occurs after decision and before action. (5) Usually Player/Player interaction only. (6) Score of 2 in Column 0.
52	Communicating Implementation-Discussion or Interpretation (External Environment)	(1) Communication other than relaying a specific decision. (2) Occurs after decision and before action. (3) Player/Player interaction only. (4) Score of 1 in Column 0.
52	Communicating Implementation-Discussion or Interpretation (Internal Environment)	(1) Communication other than relaying a specific dicision. (2) Occurs after decision and before action. (3) Player/Player interaction only. (4) Score of 2 in Column 0.

CRITERIA FOR SCORING PROCESS CATEGORIES *(Continued)*

Scoring Numbers	Process	Criteria
	COPING ACTIONS (Direct actions in response to, or to cope with, changes in the organization's environments.)	
61	Coping Actions (External Environment)	(1) Player/Controller interaction only. (2) Actions to "do something to" the external environment. (3) Does not include actions to obtain information. (4) Score of 34 in Column P concurrent with or preceding current unit. (5) Score of 1 in Column 0.
61	Coping Actions (Internal Environment)	(1) Usually Player/Controller interaction. (2) Actions to "do something to" the internal environment. (3) Does not include actions to obtain information. (4) Score of 34 in Column P concurrent with or preceding current unit. (5) Score of 2 in Column 0.
	FEEDBACK ACTIONS (Formal actions taken to obtain information about the results of Coping Actions or Stabilizing Actions.)	
71	Feedback Actions (External Environment)	(1) Action to obtain information about results of Coping Action only. (2) Player/Controller interaction only. (3) Score of 35 in Column P concurrent with or preceding current unit. (4) Score of 61 in Column P for at least one prior unit. (5) Score of 1 in Column 0.
71	Feedback Actions (Internal Environment)	(1) Action to obtain information about results of Coping Actions or Stabilizing Actions. (2) Player/Controller interaction only. (3) Score of 34 in Column P concurrent with or preceding current unit. (4) Score of 41 or 61 in Column P for at least one prior unit. (5) Score of 2 in Column 0.

Probe No. _____ Probe Name _____ SCORE SHEET (FORGE) Page _____ of _____ Pages
Group No. _____

CONTACT					IDENTIFICATION							CONTENT			PROCESS			
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q		R
Contact No. (1-9999)	Cont. Time Begin (0001-2400)	Lapse Time (01-999)	Cont. In. (1-99)	Contact Recipient(s) (1-99)	Unit No. (1-999)	Sub Unit No. (1-9)	Unit Time Begin (0001-2400)	Lapse Time (01-999)	Mode of Comm (1-6)	Unit In. (1-99)	Unit Recipient(s) (1-99)	Unit Topic (1-99)	Time of Unit (1-3)	Topic Loc. (1-2)	Pro-cess (1-99)	DCO! Follow Up Unit No. (1-99)	DCO! Follow Up Sub Un No. (1-9)	Value (1-9)

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1. REPORT NUMBER HumRRO-TR-73	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* COMPONENTS OF ORGANIZATIONAL COMPETENCE: TEST OF A CONCEPTUAL FRAMEWORK		5. TYPE OF REPORT & PERIOD COVERED Technical Report; From 1968 to 1971 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(S) Joseph A. Olmstead, Harold E. Christensen, and L.L. Lackey		8. CONTRACT OR GRANT NUMBER(S) DAHC 19-73-0004
9. PERFORMING ORGANIZATION NAME AND ADDRESS Human Resources Research Organization (HumRRO) 300 North Washington Street Alexandria, Virginia 22314		10. PROGRAM ELEMENT PROJECT TASK AREA & WORK UNIT NUMBERS 61102A; 2Q061102B74B; 02; 482
11. CONTROLLING OFFICE NAME AND ADDRESS Behavioral Sci Ofc of Sci Div (DARD-ARS-B) Office, Chief of R & D Hq, Dept. of Army		12. REPORT DATE August 1973 13. NUMBER OF PAGES 112
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

HumRRO Division No. 4
Fort Benning, Georgia
Work Unit FORGE, Sub-Unit I

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

*Applied Psychology *Organization Analysis *Simulation
*Leadership *Organization Theory
*Management Methods *Personnel Development

0501, 0509, 0510, 1407

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The study was designed to identify and explore organizational processes critical to effective functioning and to determine how functioning of the processes is influenced by environmental pressures. A framework was developed based upon the concept of Organizational Competence and an Adaptive-Coping Cycle consisting of seven critical processes. Ten 12-man groups of experienced Army officers participated in an eight-hour role simulation of

(Continued)

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20. (Continued)

a light infantry battalion engaged in combat operations. Player communications were content-analyzed for quality of process performance, and the organizations' activities were evaluated for military effectiveness. It was concluded that Organizational Competence is a principal determinant of effectiveness, that an organization's ability to respond flexibly to pressures and changes in its environments is related to its competence, and that proficient performance of the identified processes improves effectiveness.

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1	CHF OF NAV RSCH ATTN HD GP PSYCHOL BR CODE 452
1	CHF OFC PERS RSCH & REV BR USCG HQ
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1	COMDT INDUSTRIAL COLL OF ARMED FORCES FT MCNAIR
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1	PRES NAV WAR COLL ATTN MAHAN LIB
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